Final Report

ENERGY EFFICIENCY STUDY
STEAM, WATER, AND SEWER SYSTEMS

FORT GREELY, ALASKA

Prepared for

U.S. ARMY ENGINEER DISTRICT, ALASKA
ANCHORAGE, ALASKA

Under

U.S. ARMY ENGINEER DISTRICT, MOBILE
INDEFINITE DELIVERY A-E CONTRACT
Contract No. DACA01-94-D-0033
Delivery Order 003
EMC No. 1406-003

March 1996

By

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This report has been prepared at the request of the client, and the observations, conclusions, and recommendations contained herein constitute the opinions of E M C Engineers, Inc. In preparing this report, EMC has relied on some information supplied by the client, the client's employees, and others which we gratefully acknowledge. Because no warranties were given with this source of information, E M C Engineers, Inc. cannot make certification or give assurances except as explicitly defined in this report.

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LIST OF ABBREVIATIONS

ACH	-	air changes per hour
AHU	-	air handling unit
ASHRAE	-	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
Btu	-	British thermal units
Btuh	-	Btu per hour
ccf	-	one hundred cubic feet
cfm	-	cubic feet per minute
DPW	-	Department of Public Works
ECIP	-	Energy Conservation Investment Program
ECO	-	Energy Conservation Opportunity
EMC	-	E M C Engineers, Inc.
F	-	Fahrenheit
FEMP	-	Federal Energy Management Program
FLA	-	full load amperes
ft	-	foot, feet
ft^2	-	square feet
gpm	-	gallons per minute
hp	-	horsepower
hr	-	hour
HRU	-	heat recovery unit
HVAC	-	heating, ventilating, and air-conditioning
KBtu	-	one thousand British thermal units
Klb	-	one thousand pounds
kW	-	kilowatt, one thousand watts
kWh	-	kilowatt-hours, one thousand watt-hours
LCCA	-	Life Cycle Cost Analysis
MER	-	Mechanical Equipment Room
rpm	-	revolutions per minute
SF	-	square foot, feet
SIR	-	Savings-to-Investment Ratio

SOW	-	Scope of Work
SPV	-	single present value factor
SZ	-	single zone
temp.	-	temperature
U	-	thermal transmittance
UA	-	thermal transmittance x area
UPV	-	Uniform Present Value factor
yr	-	year(s)

EXECUTIVE SUMMARY

AUTHORITY FOR STUDY

This energy efficiency study of steam, potable water, and sanitary sewer systems was conducted and this report prepared under the Indefinite Delivery Architect-Engineer Contract for Energy Engineering Analysis Program (EEAP) No. DACA01-94-D-0033, Delivery Order No. 3.

PURPOSE OF STUDY

The purpose of the Energy Efficiency Study is to identify modifications necessary to provide the most energy efficient configuration of utilities (steam, water, and sewer) to serve designated active buildings at Fort Greely following implementation of the base realignment plan. Specifically the study is to evaluate central versus distributed utility systems.

UTILITY OPTIONS

The following utility options were analyzed:

- **Baseline.** The baseline reflects the current operating costs of the utilities at existing operational levels.

- **Reduced Central Utilities with Abandoned Buildings Heated to 45°F.** This option assumes continued operation of the central utilities to serve active buildings and to provide heat to utilidors and abandoned buildings to prevent deterioration.

- **Reduced Central Utilities with Abandoned Buildings Not Heated.** This option assumes continued operation of the central utilities to serve active buildings and to provide heat to utilidors to prevent freezing of water and sewer pipes.

- **Reduced Central Utilities Serving Only Active Buildings and Selected Utilidors.** This option assumes continued operation of the central utilities to serve active buildings and to provide heat to only those utilidors serving the active buildings. Steam, water, and sewer pipes in inactive utilidors would be isolated and drained. Fire hydrants served by inactive utilidors would not be operational.

- **Distributed Utilities.** This option would provide individual boilers, wells, and septic systems for each individual active building. All utilidors and existing fire

hydrants would be abandoned. Underground cisterns for fire protection would be provided in selected locations.

- **Mixed Utilities.** This option combined distributed heating and sewer systems with a central water system. Three options for freeze protection of the central water system were evaluated:

    1. **Circulation to Drain.** This option prevents freezing of the water distribution by constantly circulating water to each active building.

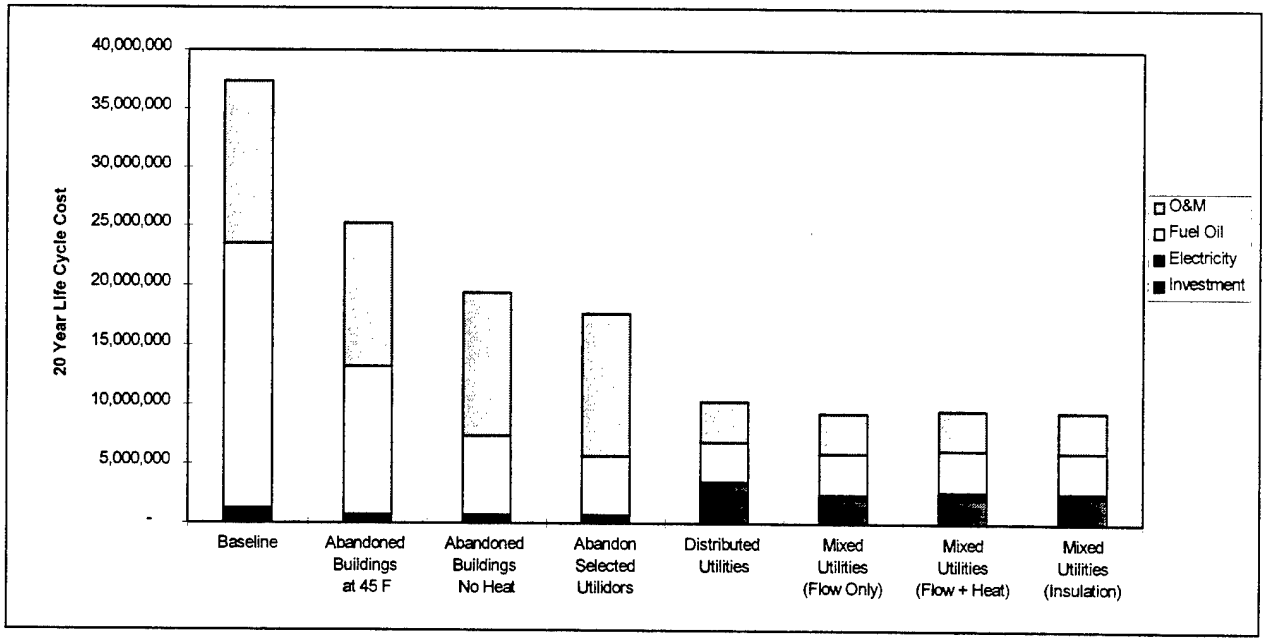
    2. **Heating and Circulation to Drain.** This option heats water circulating through the distribution system to 60°F and maintains water distribution temperatures above 32°F.

    3. **Heating, Circulation to Drain, and Pipe Insulation.** This option combines insulated water pipes with heating circulating water to 60°F and maintains water distribution temperatures above 32°F.

LIFE CYCLE COST ANALYSIS

Figure ES-1 below presents the results of the life cycle analysis.

Figure ES- 1. Graphical LCCA



The Mixed Utilities option with heating, circulation to drain, and pipe insulation for protecting the water distribution system is recommended. The mixed utilities option has

the least life cycle cost and requires the least capital investment of the utility options. The recommended freeze protection option is slightly more expensive than other freeze protection options, but it is considerably more reliable.

DISCUSSION

The study revealed the following about each utility:

- **STEAM HEATING.** The existing central steam heating plant serves over 100 building. The number of active buildings will be reduced to ten buildings. The existing central steam heating plant cannot efficiently serve only ten active buildings. Heat loss from the central steam distribution system exceeds the space heating load of the ten active buildings. Fuel oil consumption of distributed boilers would be about half that of operating the existing central steam heating plant.

  A 16 man utility staff is currently required to operate the existing central utilities with most of the staff dedicated to operating the central steam heating plant. Distributed boilers do not require continuous manning and the existing utility staff could be cut to 4 people saving about $760,000 per year.

- **WASTE WATER.** The existing central contonment area is served by a central sewer system and waste water treatment plant. The central sewer system is located in a utilidor system which must be continuously heated by heat loss from steam piping to prevent freezing of sewer pipes.

  It is not possible to operate the central sewer system unless the central steam distribution system is operated also. The alternative is a dedicated septic system for each remaining active building which also saves the energy and manpower required to operate the waste water treatment plant.

- **POTABLE WATER.** Buildings and fire hydrants in the existing central contonment area are served by a central water system which receives water from wells. There is a 180,000 gallon water storage tank on the system for fire protection. The water distribution system is located in a utilidor system which must be continuously heated by heat loss from steam piping to prevent freezing of water pipes.

  Annual operating cost of the water system is small. The capital costs of providing dedicated water wells at each active building and fire protection cisterns is high. Therefore, the central water system should be retained.

  A different method of freeze protection for the water distribution system will be required since the utilidors will no longer receive heat from the existing central steam heating system. A continuous circulation system is recommended which draws water from the wells, heats and circulates it through insulated water

distribution piping to each active building, where it is recycled to the earth via the septic system.

PROJECT ECONOMICS

Operation of existing central utilities would require little capital investment, but would incur higher than necessary operating costs. The recommended mixed utility option would require a large capital investment, but would operate more efficiently. The ECIP economic evaluation form on the following page evaluates the economics of the recommended mixed utility option relative to the most cost effective central utility option.

The results of the ECIP evaluation are a 3.0 year simple economic payback and a Savings-to-Investment Ratio (SIR) of 4.7.

RECOMMENDATIONS

The mixed utilities option with potable water freeze protection by water heating, circulation to drain, and pipe insulation is recommended. The other mixed utility options offer similar favorable economics and could be implemented with similar simple economic paybacks and SIRs. The only difference in the three mixed utility options are the method of freeze protection for the central water system. The following modifications are required:

- The central steam plant would be abandoned.
- Each remaining active building should be fitted with a steam boiler and fuel oil tank. Existing HVAC and DHW heating equipment in each building should be connected to the new steam source.
- Each remaining active building should be fitted with a septic tank and drain field.
- The portion of the existing central water system serving active buildings should be retained. The existing well and storage tanks within the central steam plant should be retained. Freeze protection should be provided for the central water system in the form of water heating, circulation to drain, and pipe insulation. Water flow for freeze protection would be recycled to the ground through the proposed septic system.

It should be noted that fire hydrants near active buildings will still be functional, but fire hydrants in the vicinity of abandoned buildings will not.

The cost of the above modifications is estimated at $2,227,641. Economic comparison of the recommended option to the most cost effective central plant option indicates a 3.0 year simple economic payback and a Savings-to-Investment Ratio (SIR) of 4.7.

1. COMPONENT	MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		Dec-95
3. INSTALLATION AND LOCATION		
Ft. Greely, Alaska		
4. PROJECT TITLE	Convert Existing Central Utilities to Distributed Utilities	5. PROJECT NUMBER

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION:	Ft. Greely, Alaska		REGION: 4	PROJECT NO:	1413-001
PROJECT TITLE:	Replace Central Utilities with Distributed Utilities			FISCAL YEAR:	1995
DISCRETE PORTION NAME:	TOTAL				
ANALYSIS DATE:	03/25/96	ECONOMIC LIFE	20	PREPARED BY:	D Jones

1.	INVESTMENT				
A.	CONSTRUCTION COST	=	=	$1,997,884	
B.	SIOH COST	(5.5% of 1A) =		$109,884	
C.	DESIGN COST	(6.0% of 1A) =		$119,873	
D.	TOTAL COST	(1A +1B +1C) =		$2,227,641	
E.	SALVAGE VALUE OF EXISTING EQUIPMENT =				
F.	PUBLIC UTILITY COMPANY REBATE =				
G.	TOTAL INVESTMENT	(1D -1E -1F) =		------->	$2,227,641

2. ENERGY SAVINGS (+) OR COST (-):

DATE OF NISTR-4942-1 USED FOR DISCOUNT FACTORS: OCT '94

	ENERGY SOURCE	FUEL COST	ENERGY SAVINGS	SAVINGS (MBtu)	ANNUAL $ SAVINGS	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECTRICITY	$0.0711 ($/kWh)	(418,883) kWh	(1,430)	($29,783)	14.47	($430,954)	
B.	DIST	0.73 ($/gal)	126,078 gal	16,959	$92,037	17.01	$1,565,545	
C.	NAT GAS							
D.	REFUS							
E.	COAL							
F.	OTHER							
G.	ELEC DEMAND	75.00 ($/kW)	34 kW		$2,563	14.47	$37,090	
H.	TOTAL				$64,817		-------->	$1,171,680

3.	NON-ENERGY SAVINGS (+) OR COST (-)				
A.	ANNUAL RECURRING (+/-)			$ 659,714	
	1 DISCOUNT FACTOR		(From Table A) =	13.47	
	2 DISCOUNTED SAVINGS (+) / COST (-)		(3A x 3A1) =		$8,886,343

B. NON-RECURRING (+/-)

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE B)	DISCOUNTED SAVINGS/COST (4)
a.				
b.				
c.				
d. TOTAL				

C.	TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-)	(3A2 + 3Bd4) =	$8,886,343

4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2H3+3A+(3Bd1/Economic Life))	$724,531
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	3.07
6.	TOTAL NET DISCOUNTED SAVINGS	(2H5 + 3C) =	$10,058,023
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	4.52

1. INTRODUCTION

1.1 AUTHORITY FOR STUDY

This energy efficiency study of the steam, potable water, and sanitary sewer systems was conducted and this report prepared under Contract DACA01-94-D-0033, Delivery Order No. 003 issued by the U.S. Army Engineers District, Mobile, to E M C Engineers, Inc. of Denver, Colorado, on approximately 8 August 1995. The delivery order was temporarily suspended until approximately 14 August 1995 when the Scope of Work was modified to include the impact of the 1995 Base Realignment and Closure (BRAC). A separate energy efficiency study of the electrical distribution system was prepared under the same delivery order number. The delivery order was managed by the U.S. Army Engineers District, Alaska, in Anchorage.

1.2 PURPOSE OF STUDY

The purpose of the Energy Efficiency Study is to identify modifications necessary to provide the most energy efficient configuration of utilities (steam, water, and sewer) to serve designated active buildings at Fort Greely following implementation of the base realignment plan. Specifically the study is to evaluate central versus distributed utility systems.

1.3 SCOPE OF WORK

The Scope of Work (SOW) for this study is defined in the contract title "Scope of Work, Energy Efficiency Study for Fort Greely, Alaska" performed as part of the Energy Engineering Analysis Program (EEAP), dated August 1995. In particular, the "General Scope of Work", pages 1 to 6 and "Annex D, Detailed Scope of Work (Revised)", pages D-1 to D-5 are relevant to the steam, water, and sanitary sewer systems. A copy of the SOW is contained in Appendix A.

The SOW requires the study to evaluate the following configurations for each utility:

- Modification of central systems to serve remaining designated active buildings.
- Installation of separate (distributed) utilities to serve each designated active building or group of buildings.

The permanent active facility list is constantly changing. EMC was furnished the following Permanent Active Facility List in Table 1-1 below on which to base the study. The buildings currently served by the existing central utilities are indicated on the table. The

active buildings currently not served by central utilities are already equipped with distributed utility systems and were not evaluated by this study.

Table 1-1. Permanent Active Facility List

Bldg. No.	Description	Location	Size (SF)
110	POL Monitoring	North Post	382
501	HQ	Cantonment	19,095
503	Gym with Pool	Cantonment	27,430
504	Fire Station	Cantonment	6,192
605	Consolidated PW	Cantonment	24,915
606	Central Steam Plant	Cantonment	30,334
607	Steam Plant Annex	Cantonment	999
612	Tank Maintenance	Cantonment	18,681
615	Roads and Grounds	Cantonment	17,351
617	POL Operation	North Fort	448
618	POL Operation	North Fort	621
625	Pump House	Cantonment	293
633	Sewage Treatment	Cantonment	2,784
638	Sewage Lagoon	Cantonment	742
639	Contact Chamber	Cantonment	696
658	Temp Motor Pool	Cantonment	25,425
725	School	Cantonment	54,604
820	Housing	Cantonment	16,175
821	Housing	Cantonment	16,175
1419	Range	Mississippi Range	960
1928, 1930	CRTA Complex	Bollo Labs	35,061
1343, 1350, 1352	Range	Beales Range	4,968
1600, 1605, 1606	Range	Test Ranges	6,211
2013, 2019, 2025	NWTC Complex	Black Rapids	39,218
		Total	**349,760**

Shaded buildings are served by central utilities.

1.4 APPROACH

A detailed field survey was completed the last week of August 1995. The following options were evaluated:

- Baseline. A baseline economic model for operation of the central steam, water, and sewage systems was developed which reflects the current operating costs of the utilities. The economic model includes electrical and fossil energy costs and operations and maintenance costs.

- Reduced Central Utilities. The baseline economic model was then modified to reflect the reduced mission of the Fort assuming central utility systems would be retained. The inactive buildings were assumed to be taken off the utilities.

- Distributed Utilities. Cost savings and implementation costs for distributed utilities were evaluated. Distributed utilities would provide individual utilities for each active building in the form of individual boilers, wells, and septic systems.

- Mixed Utilities. A combination of central and distributed utilities was evaluated.

The options were then compared using life cycle cost analysis and recommendations made.

1.5 ORGANIZATION OF REPORT

This report is organized as follows:

- Section 2 examines the existing baseline utilities.

- Section 3 examines the existing central utilities operating at reduced capacity.

- Section 4 evaluates distributed utilities.

- Section 5 evaluates combined distributed and central utilities.

- Section 6 presents the life cycle cost analysis.

- Section 7 summarizes the results of the analysis and makes recommendations.

2. BASELINE UTILITY SYSTEMS

The existing utility systems were investigated to establish models for the operating costs of existing utilities and to verify these baseline models with historical data. Once these baseline models were established, they were modified to reflect the reduced mission of Fort Greely.

2.1 CENTRAL STEAM HEATING SYSTEM

2.1.1 Description

The central steam plant contains three boilers which were installed in 1954. Two of these boilers were replaced in 1993, and one original boiler remains in service. All boilers have been very well maintained and are in excellent condition. The steam distribution piping, which is accessible in the utilidors, has also been very well maintained. The field survey team commented that Fort Greely has the cleanest, best maintained central steam plant they have seen at a military base.

The three existing central steam heating system boilers are each rated at 50,000 pounds per hour (LBH) of 120 psig steam. The boilers have a maximum working pressure of 160 psig and produce no superheat. Boiler fuel is No. 2 arctic diesel oil with a higher heating value of about 134,500 Btu per gallon. Each boiler is equipped with both forced and induced draft fans equipped with 25 horsepower electric motors. The exception is Boiler 3, which has a 40 horsepower induced draft fan.

Steam is distributed at 120 psig to the buildings in the central cantonment area through steam piping running through underground utilidors. Utilidors are concrete passageways buried about 6 feet underground through which steam, potable water, and sewer pipes are routed. Figure 2-1 on the following page is a diagram of the utilidor system at Fort Greely. Heat loss from the steam pipes provide sufficient heat to prevent freezing of the water and sewer pipes.

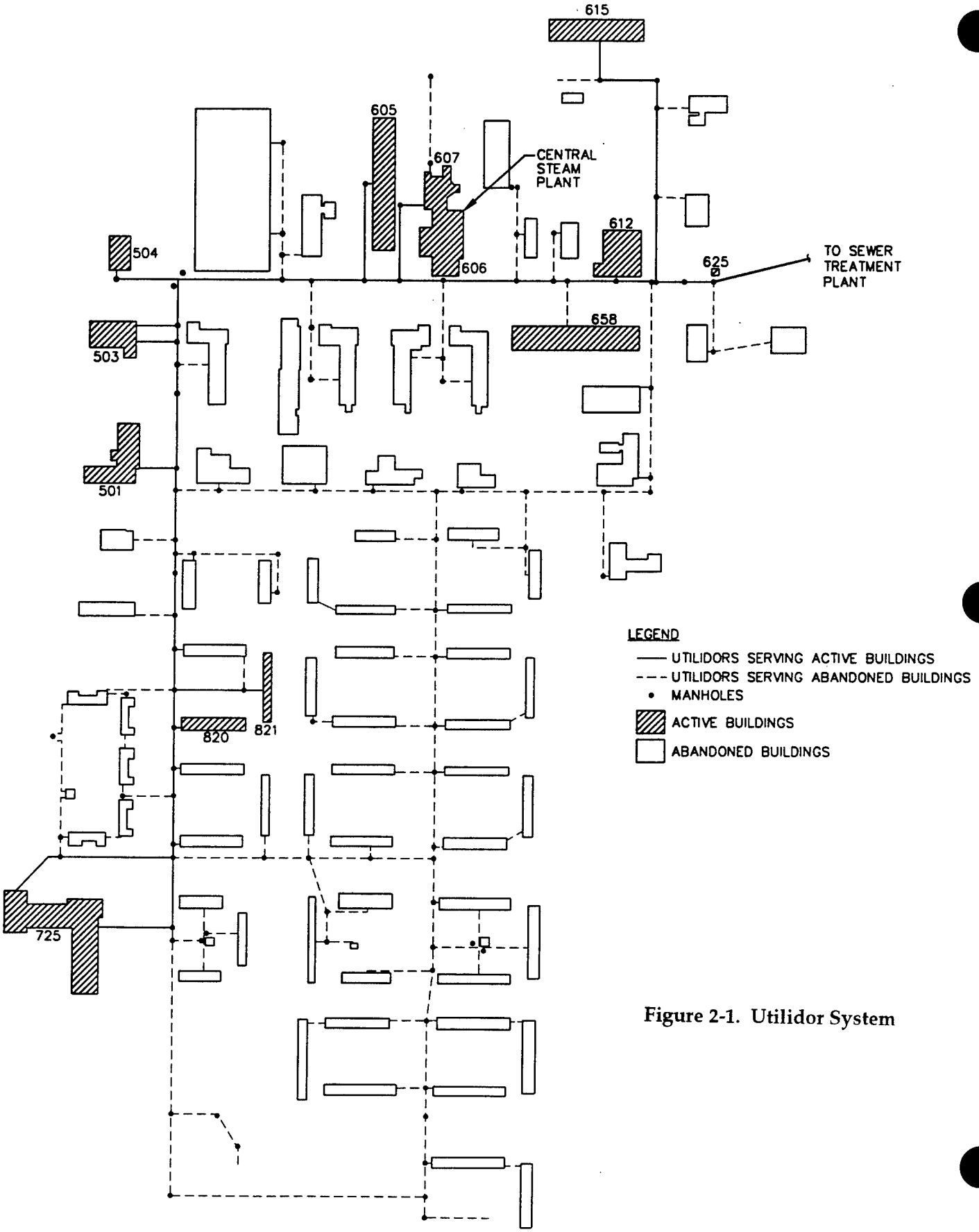
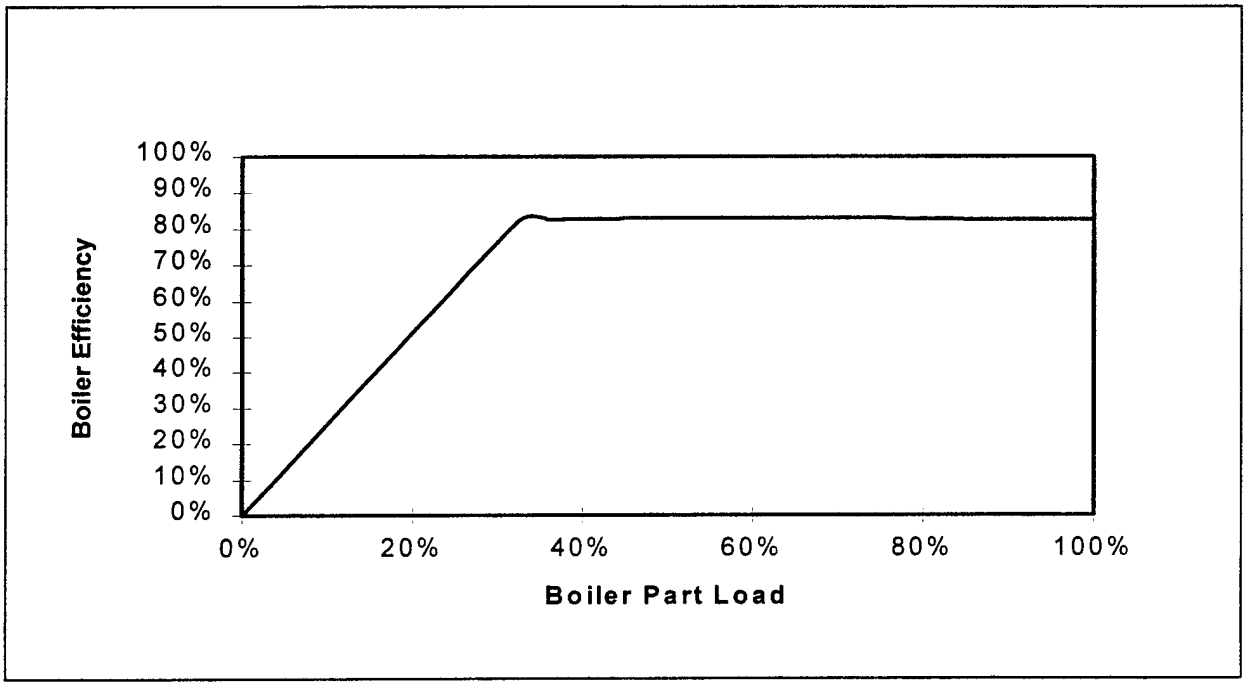


Figure 2-1. Utilidor System

2.1.2 Performance

The existing central steam heating system efficiency analysis was based on a previous energy study completed in 1977. The following efficiency curve for Boilers 1, 2, and 3 resulted.

Figure 2-2. Boiler Efficiency Curve



Boiler efficiency is about 83% between 30% and 100% of the boiler part load. The boiler efficiency drops off rapidly below 30% part load. The portion of the curve at a part load less than 30% was extrapolated. This curve is typical of boilers of this type. Taking all three boilers into consideration, efficient operation is possible in the 10% to 100% plant capacity range.

2.1.3 Energy Consumption

The central steam distribution system currently serves 101 buildings with a total floor area of 1,256,172 square feet. Total annual steam use was calculated as follows:

- **Space Heating** is the major consumer of steam. Space heating requirements in buildings using steam from the central steam plant were extrapolated from energy simulations on the Ft. Greely school. The school was simulated using the DOE-2.1d building energy simulation program. The program was used to calculate heating loads and building energy consumption during the course of a typical

meteorological year. The existing building configuration and operating conditions at the time of the field survey were modeled as the baseline conditions. The weather data for Big Delta, Alaska was used for the simulation.

Total annual steam use for space heating of applicable buildings totaled 122,170 MBtu.

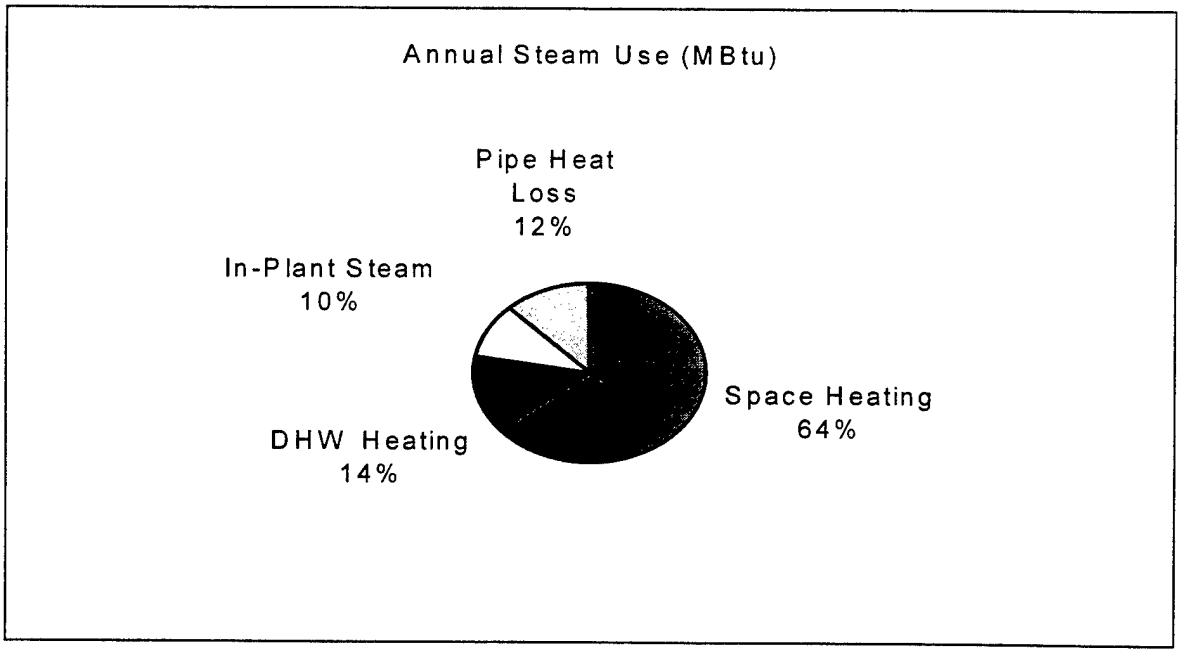
- **Pipe Heat Loss** from the central steam heating distribution system and condensate return system was taken from the 1977 energy study. Heat loss remains constant throughout the year at 2,705 MBH or a total or 23,700 MBtu per year. Pipe heat loss prevents freezing of potable water and sewer pipes in the utilidors.

- **Domestic Water Heating** (DHW) steam use was estimated based on total steam production in July less steam use in the heating plant, pipe heat loss from the distribution system, and space heating steam use. Space heating steam use for the Fort was extrapolated from the computer model of the school. Annual energy used for DHW was estimated at 26,486 MBtu.

- **Deaerator (DA) Heater** in the central steam plant was estimated to consume 10% of the steam produced by the boilers.

Figure 2-3 below illustrates the distribution of annual steam use. As can be seen space heating consumes 64% of the steam produced. Total annual steam use is 190,850 MBtu. A total of 1,791,484 gallons per year of arctic fuel oil is consumed to produce the required steam. Consumption of electricity by central steam plant auxiliaries was estimated at 466,502 kWh.

Figure 2-3. Distribution of Annual Steam Use



2.1.4 Operation and Maintenance Costs

The utilities at Fort Greely are operated by a 16 man Utility Department. The average burdened cost of personnel is about $35 per hour according to the Business Office at Fort Greely. For the purposes of this study, the costs of O&M personnel were divided among the utilities as follows:

- **Central Steam Heating System** - The central steam plant is manned continuously by 2 central plant operators in the winter and one operator in the summer. In addition various mechanics are required for maintenance.

- **Central Sewer System** - O&M was assumed to require 100% of the water treatment mechanic's time and 15% of the foreman's time.

- **Central Water System** - O&M was assumed to require 50% of the general mechanic's time and 5% of the foreman's time.

Table 2-1 below summarizes the O&M personnel costs.

Table 2-1. O&M Cost Summary

	No. of Maintenance Personnel Required			
	Steam System	Water System	Sewer System	Total Utilities
Foreman	0.80	0.05	0.15	1.00
Steam Fitter	1.00			1.00
Electrician	1.00			1.00
General Mechanic	0.50	0.50		1.00
Water Treatment Mechanic	-	-	1.00	1.00
Power Systems Mechanic	1.00			1.00
Boiler Operators	10.00			10.00
Subtotal	14.30	0.55	1.15	16.00
Annual Hours per Man	1,820	1,820	1,820	1,820
Burdened Cost per Hour	35.00	35.00	35.00	35.00
Annual Operating Cost	910,910	35,035	73,255	1,019,200

2.2 CENTRAL WATER SYSTEM

2.2.1 Description

The central water system consists of water wells serving facilities in the central cantonment area through a water distribution system located in utilidors.

The primary wells for the system are Well 9, located in the central steam plant, and Well 8 located east of the central steam plant. Well pumps for Wells 8 and 9 have motors of 50 and 60 horsepower, respectively. These wells are operated alternately to fill a 180,000 gallon atmospheric storage tank located within the central steam plant. In addition, there is one other well located on the system near the central heating plant which can be used to supplement the water supply. The well depths vary from 270 to 400 feet deep while the water table is about 200 feet. Chlorination is applied as the water leaves the wells. Building 501 has its own well which may be used in an emergency to supply Building 501.

Water is pumped from the storage tank into two 20,000 gallon pressure tanks by 25 and 30 horsepower pumps. The pressure tanks directly feed the water distribution system. In addition, a 50 horsepower pump is available to pump into the water distribution system from the atmospheric storage tank in the event of a fire. The water distribution system is operated at a pressure of about 55 psig.

The water distribution system consists of a potable water piping looped system located mainly in utilidors. A long section of piping in a Rickwil, pipe in pipe, system serves the sewage treatment plant. Besides serving the facilities in the central cantonment area, the water distribution system also serves fire hydrants spaced throughout the area.

Most of the water consumed is used within the buildings for normal activities. Potable water from the system is also used continuously to cool condensers in the commissary. Additional potable water is used at the sewage treatment plant.

Steam piping parallels the water distribution piping in the utilidors and Rickwil system. Heat loss from the steam piping prevents freezing of piping in the utilidors. Without steam winter operation of the existing water distribution system would be impossible.

2.2.2 Energy Consumption

Electric energy for the well and pressurization pumps is the only energy required to operate the system. Annual electric use is presented in paragraph 2.5.

2.2.3 Operation and Maintenance Costs

O&M costs are summarized in paragraph 2.1.4 above.

2.3 CENTRAL SEWER SYSTEM

2.3.1 Description

The central sewer system consists of a sewer system serving facilities in the central cantonment area and a sewage treatment plant to the east.

The sewer system consists of sewer piping located mainly in utilidors. A long section of piping in a Rickwil, pipe-in-pipe, system carries sewage to the sewage treatment plant. Steam piping parallels the sewer piping in the utilidors and Rickwil system. Heat loss from the steam piping prevents freezing of piping in the utilidors. Without steam, winter operation of the existing central sewer system would be impossible.

The sewage treatment plant is comprised of an Imhoff tank, sludge drying beds, aerated lagoons, and a chlorination facility. The current treatment scheme includes the following processes:

- The **Imhoff Tank** provides primary clarification and sludge stabilization. The 120,000 gallon Imhoff tank is enclosed within a heated building. Energy using equipment includes the following:

    ◊ One sludge pump rated at 5 hp that operates approximately 1/2 hr every 10 to 14 days.

    ◊ Two effluent pumps rated at 10 hp each, operating 3 to 4 hours per day.

    ◊ One Imhoff exhaust fan rated at 2 hp that operates 1 hour per week.

- **Aerated Lagoons** provide biological treatment for effluent from the Imhoff tank. There are two aerated lagoons each approximately 200 feet long and 200 feet wide with an average operating depth of 10 feet. Air supplied by two positive displacement blowers (one duty, one standby) is delivered through diffusers mounted in a grid pattern along the floor of the each lagoon. Each blower is powered by a 30 hp motor. One blower operates continuously to prevent icing of the lagoon.

- **Sludge Drying Beds** or more accurately "freezing beds" receive sludge from the Imhoff tank. The sludge drying beds are cleaned out annually by loaders and trucks for transport to a landfill.

- A **Chlorination Facility** receives effluent from the aerated lagoons and provides disinfection before discharge of effluent to Jarvis Creek.

2.3.2 Energy Consumption

Electric energy is required for pumps, and for aeration at the sewage treatment plant. Annual electric use is presented in paragraph 2.5.

2.3.3 Operation and Maintenance Costs

O&M costs are summarized in paragraph 2.1.4 above.

2.4 UNIT ENERGY COSTS

The demand and energy costs for electricity delivered to Fort Greely from GVEA and Fort Wainwright were taken from data provided by Fort Wainwright personnel. Approximately 83% of the electric energy used at Fort Greely is derived from Fort Wainwright generators and wheeled over GVEA distribution lines for the cost of wheeling. The remaining 17% is purchased directly from GVEA at a cost based on their GS-2 rate schedule. Demand charges are based on the peak kW used per month, regardless of whether it is wheeled or purchased power. In order to simplify the analysis for this study, the energy costs were averaged over the one year period starting on the first day of September 1993 and ending on the last day of August 1994. The demand charge remains the same in either case. The electric rates used in this study are as follows:

- Electric demand charge: $6.25/kW/month.
- Electric energy charge: $0.0711 per kWh.

Arctic fuel oil for central steam plant and distributed boilers historically has been purchased at a cost of $0.73 per gallon.

2.5 BASELINE UTILITY COST SUMMARY

Table 2-2 on the following page summarizes the baseline annual costs associated with the central utilities.

Table 2-2. Baseline Utility Costs

Utility	Annual Cost $
Steam System	-
Fuel Oil Use (gal)	1,791,484
Electricity Use (kWh)	466,502
Electric Demand (kW)	85
Fuel Oil Cost ($)	1,307,783
Electricity Cost ($)	39,576
O&M Cost ($)	910,910
Total Steam Cost ($)	**2,258,270**
-	-
Water System	-
Water Use (gal)	9,585,079
Electricity Use (kWh)	387,853
Electric Demand (kW)	-
Electricity Cost ($)	27,576
O&M Cost ($)	35,035
Chlorination Costs ($)	4,026
Total Water Cost ($)	**66,637**
-	-
Sewer System	-
Effluent (gal)	7,197,281
Electricity Use (kWh)	251,919
Electric Demand (kW)	-
Electricity Cost ($)	19,502
O&M Cost ($)	73,255
Chlorination Costs ($)	4,020
Total Sewer Cost ($)	**96,777**
-	-
Total Utilities	-
Fuel Oil Use (gal)	1,791,484
Electricity Use (kWh)	1,106,274
Electric Demand (kW)	85
Electricity Cost ($)	86,654
Fuel Oil Cost ($)	1,307,783
O&M Cost ($)	**1,027,246**
Total Utilities Cost ($)	**2,421,683**

3. OPERATION OF EXISTING UTILITIES AT REDUCED CAPACITY

This section modifies the baseline central utility models to reflect the reduced mission at Fort Greely and the resulting utility operating costs are computed.

3.1 CENTRAL STEAM SYSTEM

Three options for operation of the central steam system at reduced capacity were investigated. These options are described below.

3.1.1 Central System with Abandoned Buildings Maintained at 45°F

This option would maintain indoor air temperatures within abandoned buildings at 45°F. It has been reported that buildings deteriorate rapidly in this climate without heat. A study is currently underway at Fort Wainwright regarding this subject.

The option would be implemented by lowering thermostat setpoints within the abandoned buildings. In cases where thermostats do not have the range to accommodate the desired lower temperature, they may be replaced with an inexpensive thermostat with the proper range. No other modifications would be required.

With lowered setpoints in abandoned buildings, fuel oil consumption at the central steam plant would be reduced. Pipe heat loss will be unaffected as will O&M costs. Paragraph 3.4 summarizes resulting energy and O&M costs.

3.1.2 Central System with No Heat to Abandoned Buildings

This option would require shutting off steam valves within the abandoned buildings to prevent steam use. Steam would continue to be supplied to the utilidors to prevent water and sewer pipes from freezing. This would allow fire hydrants to remain functional.

With no steam to abandoned buildings, fuel oil consumption at the central steam plant would be reduced. Pipe heat loss will be unaffected as will O&M costs. Paragraph 3.4 summarizes resulting energy and O&M costs.

3.1.3 Central System with Isolation of Selected Utilidors

This option would shut off steam to abandoned buildings and isolate selected sections of utilidors. Fire hydrants in the vicinity of abandoned buildings would no longer be operational.

The option would require shutting steam and water valves on steam pipes serving selected utilidors. Sewer pipes serving these utilidors should be cut and capped to prevent migration of sewer gasses into abandoned buildings. Abandoned utilidors should be isolated from active utilidors with partitions to prevent heat loss. Steam would continue to be supplied to the selected utilidors to prevent water and sewer pipes from freezing. This would allow fire hydrants served by selected utilidors to remain functional.

With no steam to abandoned buildings and selected utilidors, fuel oil consumption at the central steam plant would be reduced. Pipe heat loss will be reduced, but O&M costs will remain constant. Paragraph 3. 4 summarizes resulting operating costs.

3.1.4 Comparison of Central Steam System Options

Table 3-1 below presents the steam use for the baseline and the three options for reduced operation of the central steam plant.

Table 3-1. Steam Use for Central Steam Plant Options

	Annual Steam Use (MBtu)			
	Baseline	Abandoned Buildings at 45 F	Abandoned Buildings No Heat	Abandon Selected Utilidors
Space Heating	122,170	68,839	23,407	23,407
Water Heating	26,486	5,427	5,427	5,427
Steam Plant	19,085	9,737	5,194	3,842
Pipe Loss	23,109	23,109	23,109	9,589
Total	190,850	107,112	57,137	42,265

The following observations are evident:

- Maintaining 45°F in abandoned buildings would reduce steam use to about 57% of existing baseline use.

- Shutting off heat to abandoned buildings would reduce steam use to about 27% of existing baseline use. For this option heat loss from distribution steam piping exceeds energy used for space heating.

- Abandoning selected utilidors would save an additional 13.5 MBtu per year and would reduce steam use to about 19% of existing baseline use.

3.2 CENTRAL WATER SYSTEM

Operation of the central water system at reduced capacity should not require any modifications to the existing system. Annual water use is projected to drop from 115 to 8 million gallons per year.

Cost savings will result from reduced electricity use by well and pressurization pumps and reduced chlorination costs. Annual electricity cost attributable to the central water system would decrease in proportion to water use. Annual chlorination costs are would also decrease in proportion to water use. Paragraph 3. 4 summarizes resulting operating costs.

3.3 CENTRAL SEWER SYSTEM

Operation of the central sewer system at reduced capacity should not require any major modifications to the existing system. Annual sewage to be treated is projected to drop from 86 to 6 million gallons per year. Only one of the two existing sewage lagoons will be required with the reduced flow of effluent.

Cost savings will result from reduced electricity use for sewage treatment equipment. No other cost reductions are anticipated. Paragraph 3.4 summarizes resulting operating costs.

3.4 REDUCED CAPACITY CENTRAL UTILITY COST SUMMARY

Table 3-2 on the following page presents anticipated maintenance costs for central utilities operating at reduced capacity. The total utility staff is expected to drop from 16 to 14 people.

Table 3-2. Reduced Central Utility O&M Cost Summary

	Number of Maintenance Personnel Required			
	Steam System	Water System	Sewer System	Total Utilities
Foreman	0.80	0.05	0.15	1.00
Steam Fitter	1.00			1.00
Electrician	1.00			1.00
General Mechanic	0.50	0.50		1.00
Water Treatment Mechanic	-	-	1.00	1.00
Power Systems Mechanic	1.00			1.00
Boiler Operators	8			8
Subtotal	12.30	0.55	1.15	14.00
Annual Hours per Man	1,820	1,820	1,820	1,820
Burdened Cost per Hour	35	35	35	35
Annual Operating Cost	783,510	35,035	73,255	891,800

Table 3-3 below summarizes the annual costs associated with the central utilities operating at reduced capacity. The most cost effective option would shut off steam to abandoned buildings and isolate selected sections of utilidors. Fire hydrants in the vicinity of abandoned buildings would no longer be operational.

Table 3-3. Utility Costs of Central Utility Systems Operating at Reduced Capacity

Utility	Abandoned Buildings at 45 F	Abandoned Buildings No Heat	Abandon Selected Utilidors
Steam System			
Fuel Oil Use (gal)	1,005,444	536,336	396,735
Electricity Use (kWh)	344,794	332,179	332,179
Electric Demand (kW)	39	38	38
Fuel Oil Cost ($)	733,974	391,525	289,617
Electricity Cost ($)	27,467	26,462	26,462
O&M Cost ($)	783,510	783,510	783,510
Total Steam Cost ($)	***1,544,951***	***1,201,497***	***1,099,589***
Water System			
Water Use (gal)	996,820	996,820	996,820
Electricity Use (kWh)	40,336	40,336	40,336
Electric Demand (kW)	-	-	-
Electricity Cost ($)	2,868	2,868	2,868
O&M Cost ($)	35,035	35,035	35,035
Chlorination Costs ($)	419	419	419
Total Water Cost ($)	***38,322***	***38,322***	***38,322***
Sewer System			
Effluent (gal)	816,163	816,163	816,163
Electricity Use (kWh)	251,919	251,919	251,919
Electric Demand (kW)	-	-	-
Electricity Cost ($)	19,502	19,502	19,502
O&M Cost ($)	73,255	73,255	73,255
Chlorination Costs ($)	272	272	272
Total Sewer Cost ($)	***93,029***	***93,029***	***93,029***
Total Utilities			
Fuel Oil Use (gal)	1,005,444	536,336	396,735
Electricity Use (kWh)	637,048	624,434	624,434
Electric Demand (kW)	39	38	38
Electricity Cost ($)	49,836	48,831	48,831
Fuel Oil Cost ($)	733,974	391,525	289,617
O&M Cost ($)	892,491	892,491	892,491
Total Utilities Cost ($)	***1,676,301***	***1,332,847***	***1,230,939***

4. DISTRIBUTED UTILITY SYSTEMS

In this section distributed utility systems which provide individual heating, potable water, and sewer systems for each individual building are evaluated and resulting utility operating costs are computed.

4.1 DISTRIBUTED HEATING SYSTEMS

4.1.1 Description

This option would abandon the central steam plant and place a dedicated steam boiler and fuel oil tank at each active building. The central distribution utilidor would be abandoned. The anticipated benefits of this option are:

- Elimination of pipe heat loss in the utilidors which will exceed space heating loads of the remaining active buildings.
- Reduction of O&M costs.

A major disadvantage of this option is that is that water, sewer, and fire protection services also must be distributed or alternative freeze protection provided. It is difficult to operate central water and sewer systems without a heated utilidor system. Currently, utilidors are heated by heat loss from the central steam distribution piping.

A boiler sized to meet the space and DHW heating loads of each building was selected. Table 4-1 on page 4-2 indicates the remaining active buildings and the required boiler capacity.

Distributed boilers were assumed to produce 15 psig steam to serve the existing space and DHW systems in each building. Space within the heated envelope of each building would be required for the new boilers. Some piping modification and installation of a boiler flue would also be required.

Table 4-1. Distributed Boiler Sizing and Energy Use

Bldg #	Building Description	Required Boiler Capacity (MBH)	Annual Consumption		Annual Energy Cost	
			Fuel Oil (gal)	Electricity (kwh)	Fuel Oil ($)	Electricity ($)
501	Post HQ	754	20,080	17,870	17,590	1,271
503	Gymnasium	1,083	28,846	17,870	25,269	1,271
504	Fire Station	245	6,512	15,137	5,704	1,076
605	Consolidated PW	984	26,201	22,075	22,952	1,570
606	Central Heating Plant	1,238	32,950	22,075	28,864	N/A
612	Tank Maintenance	738	19,645	22,075	17,209	1,570
615	Buildings & Grounds	685	18,246	17,870	15,984	N/A
658	Temp. Motor Pool	1,004	26,737	17,870	23,422	1,271
725	School	2,157	57,422	32,797	50,302	2,332
820	Housing Unit	639	17,010	17,870	14,900	1,271
821	Housing Unit	639	17,010	17,870	14,900	1,271
	TOTALS	**9,527**	**253,648**	**203,512**	**222,196**	**11,630**

Two boilers are recommended for each building and each boiler sized to provide 100% of the peak demand to prevent freezing in the buildings should one boiler fail. Each building should be equipped with a simple freeze detection system consisting of a thermal switch in the heated space wired to an audible alarm or flashing light to indicate a problem.

The boilers would be fired with arctic fuel oil and a new fuel tank would be required for each building. Codes allow fuel oil tanks up to 650 gallons to be located within the heated space. However, larger underground tanks are recommended to reduce the frequency of fuel delivery. Fuel tanks ranging in capacity from 1000 to 5000 gallons were included in the cost estimates for distributed boilers.

The proposed fuel tanks hold less fuel than the existing large fuel tank and will require more fuel purchases more frequently in smaller quantities. Unit fuel prices are expected to increase by 20%.

4.1.2 Energy Consumption

This option would reduce energy consumption by eliminating central steam plant steam use for auxiliaries and by eliminating pipe heat loss in the central distribution system. Total fuel oil consumption in the central cantonment area would drop significantly. Electricity use would also be reduced. Paragraph 4.5 summarizes resulting energy costs.

4.2 DISTRIBUTED WATER SYSTEMS

4.2.1 Description

Distributed water systems would require drilling new water wells adjacent to each building and installing dedicated well pumps and pressure tanks for each building. Chlorination would not likely be required. Wells should be drilled about 250 feet deep.

The central water distribution system would be abandoned. Fire hydrants would no longer be available for fire protection. Water for fire protection would be provided by eleven 50,000 gallon cisterns spaced near active buildings.

4.2.2 Energy Consumption

Electricity use by well and booster pumps would not change over the reduced central utility option. The same amount of water pumped from the same 250 foot deep underground aquifer would be required.

4.3 DISTRIBUTED SEWAGE DISPOSAL SYSTEMS

4.3.1 Description

Distributed sewer systems would consist of septic tanks and drain fields serving each building. Each system would be composed of:

- Cast iron pipe extending from a connection on existing sanitary waste drain to a septic tank
- A gravity flow, two compartment septic tank sized to accommodate each buildings maximum daily flow requirements
- A distribution box to evenly distribute the effluent to each distribution pipe.
- Perforated distribution pipe buried a depth of 10 feet below the surface to avoid freezing. The perforated distribution pipe should wrapped with geotextile fabric. The backfill of each trench should be 12 inches of gravel, 3 feet of sand and the remainder to be filled with select backfill.

The area of the drain field is based upon the size of each septic tank assuming a worst condition of soil composed of clay with small amounts of sand or gravel.

4.3.2 Energy Consumption

Distributed sewage disposal systems in the form of septic systems require no energy to operate.

4.4 OPERATIONS AND MAINTENANCE COSTS

The advantage of distributed utilities at Fort Greely is that maintenance costs may be significantly reduced. O&M costs were projected as follows:

- Small distributed boilers do not require continuous manning. However, considering the harsh climate and the isolated location, a simple alarm system to indicate freezing conditions in active buildings is recommended. It is assumed that security personnel would be on duty to monitor alarms.

- Water wells require minimal maintenance. Chlorination will not likely be required.

- Distributed sewage disposal systems require minimal maintenance. Currently one full time mechanic is required for operation of the sewage disposal system. It is anticipated that a full time mechanic for sewage disposal will no longer be required.

It is anticipated that the utilities maintenance staff could be reduced to four people. Table 4-2 below summarizes the O&M costs.

Table 4-2. Distributed Utilities O&M Cost Summary

	Number of Maintenance Personnel Required			
	Steam System	Water System	Sewer System	Total Utilities
Foreman	0.60	0.3	0.1	1.00
Steam Fitter	1.00	--	--	1.00
Electrician	--	--	--	--
General Mechanic	1.2	0.6	--	2.00
Water Treatment Mechanic	--	--	--	--
Power Systems Mechanic	--	--	--	--
Boiler Operators	--	--	--	--
Subtotal	2.80	0.90	0.30	4.00
Annual Hours per Man	1,820	1,820	1,820	1,820
Burdened Cost per Hour	35	35	35	35
Annual Operating Cost	178,360	57,330	19,110	254,800

4.5 DISTRIBUTED UTILITIES COST SUMMARY

Table 4-3 on below summarizes the annual costs associated with the distributed utility option.

Table 4-3. Distributed Utility Costs

Utility	Annual Cost
Steam System	-
Fuel Oil Use (gal)	270,658
Electricity Use (kWh)	221,383
Electric Demand (kW)	4
Fuel Oil Cost ($)	197,580
Electricity Cost ($)	17,636
O&M Cost ($)	178,360
Total Steam Cost ($)	**393,576**
	-
Water System	-
Water Use (gal)	996,820
Electricity Use (kWh)	40,336
Electric Demand (kW)	-
Electricity Cost ($)	2,868
O&M Cost ($)	57,330
Chlorination Costs ($)	-
Total Water Cost ($)	**60,198**
Sewer System	-
Effluent (gal)	816,163
Electricity Use (kWh)	-
Electric Demand (kW)	-
Electricity Cost ($)	-
O&M Cost ($)	19,110
Chlorination Costs ($)	-
Total Sewer Cost ($)	**19,110**
Total Utilities	-
Fuel Oil Use (gal)	270,658
Electricity Use (kWh)	261,718
Electric Demand (kW)	4
Electricity Cost ($)	20,504
Fuel Oil Cost ($)	197,580
O&M Cost ($)	254,800
Total Utilities Cost ($)	**472,884**

4.6 IMPLEMENTATION COSTS

Replacement of central utilities with distributed utilities will incur a substantial implementation cost. Table 4-4 below summarizes the implementation costs. Appendix E contains detailed cost estimates for installation of distributed utilities.

Table 4-4. Distributed Utility Implementation Costs

Description	Steam ($)	Water ($)	Sewer ($)	Total ($)
Distributed Steam Boilers	778,779			778,779
Boiler Fuel Systems	388,761			388,761
Water Wells & Fire Cisterns		1,039,861		1,039,861
Septic Systems			667,277	667,277
Total Construction Cost ($)	1,167,540	1,039,861	667,277	2,874,678
SIOH (5.5%)	64,215	57,192	36,700	158,107
Design (6%)	70,052	62,392	40,037	172,481
Total Investment Cost ($)	1,301,807	1,159,445	744,014	3,205,266

5. MIXED UTILITY SYSTEMS

This section explores mixed utility systems which are a combination of central and distributed utilities. Steam and sewer would be converted to distributed systems and the central water system would be retained.

5.1. INTRODUCTION

Central utility systems operating at reduced capacity were evaluated in Section 3. Distributed utility systems were evaluated in Section 4. Table 5-1 below summarizes the results of the analysis for distributed utilities.

Table 5-1. Summary of Central and Distributed Utilities

Description	Steam	Water	Sewer
Operating Costs			
Central Utilities	1,099,589	38,322	93,029
Distributed Utilities	393,576	60,198	19,110
Distributed Utility Savings	706,013	(21,876)	73,919
Implementation Costs			
Distributed Utilities	1,301,807	1,159,445	744,014
Economics			
Simple Economic Payback (yrs)	1.84	(53.00)	10.07

As can be seen, the distributed heating systems have an excellent economic payback of about two years. In other words, operating cost savings will pay for the cost of new distributed boilers in less than two years. Distributed septic systems have an economic payback of 10 years. Distributed water systems in the form of wells and fire cisterns at each building have no economic payback due to higher O&M costs. The problem with distributed water systems is a high investment cost and no savings in operating costs.

Obviously, given the economics, the water system should remain centralized. However, it is difficult to operate central water or sewer systems without a heated utilidor system. Currently utilidors are heated by heat loss from the central steam distribution piping. The following section discusses options for freeze protection of the central water systems.

5.2. FREEZE PROTECTION OF CENTRAL WATER SYSTEMS

The freeze protection method most appropriate for Fort Greely would likely be the one with the lowest initial cost; given the uncertain future of the Fort. Possible methods of water pipe freeze protection are:

- Burial below the frost line
- Electric or steam heat trace of pipe
- Recirculation
- Heating entering water
- Circulation flow to drain
- Insulation
- Combination of the above

Burial below the frost line is not economically feasible. Heat tracing is not reliable and is costly if electricity is used. Recirculation is possible, but pipe heat loss would double due to the return loop. The recirculation method would likely require heat tracing from the mains to the buildings. These options were not considered further.

The lowest cost option for freeze protection is a combination of the next three options. Circulation flow to drain maintains the movement of water in the central water distribution piping by allowing a controlled amount of water to constantly flow down the drain in each active building. Because the entering ground water temperature is about 38°F, heating the water entering the distribution system may also be desirable. The cost effectiveness of adding insulation to water piping was also investigated.

Using the combined options described above, a model of heat loss from the water distribution piping was developed. The model calculates the temperature drop of water flowing through the pipes to active buildings and predicts the lowest water temperature in the system. A utilidor temperature of 0°F was assumed.

The freezing of water flowing in a pipe occurs in four distinct stages[1]:

- **Sub-cooling.** Studies show that water flowing in a pipe will not form ice above a water temperature of 22 to 24°F.

- **Ice crystal formation.** Below 24°F ice crystals will form in the flowing water. Water will continue to flow but at a slower rate due to increased viscosity from the ice crystals.

[1]Orlando Andersland and Duwayne Anderson, Editors, Geotechnical Engineering for Cold Regions, McGraw-Hill.

- **Annular ice formation.** At some point in time after ice crystal formation, ice will begin to form on the interior surface of the pipe which will eventually block the flow.

- **Solid ice formation.** Remaining water trapped by annular ice formation will freeze creating stress in the pipe and possibly rupture the pipe.

5.3. FREEZE PROTECTION OPTIONS

Three freeze protection options were investigated:

- **Circulation to Drain.** This option maintained water temperatures above 28°F.

- **Water Heating and Circulation to Drain.** This option heated water entering the water distribution system to 60 F and maintained water temperatures above 32°F.

- **Heating, Circulation to Drain, and Pipe Insulation.** This option insulated water pipes, heated water entering the water distribution system to 60°F, and maintained water temperatures above 32°F.

Table 5-2 on page 5-4 summarizes analysis of the three freeze protection options. As can be seen, freeze protection of the water distribution system has a relatively small cost, adding a maximum of $26,000 per year to operating costs. The optimal freeze protection option is dependent on the life cycle cost analysis which is presented in Section 6.

Table 5-2. Three Freeze Options

	Distributed Water System	Water Flow	Water Flow Water Heat	Water Flow Water Heat Pipe Insulation
Freeze Protection				
Required Flow Rate (gpm)	N/A	74	32	13
Annual Water Consumption (gal)	N/A	19,315,800	8,278,200	3,285,000
Annual Well Pump Electricity (kWh)	N/A	781,597	334,970	132,925
Annual Electric Cost ($)	N/A	16,489	7,067	2,804
Annual Chlorination Cost ($)	N/A	8,125	3,482	1,382
Annual Energy Consumption (MBtu)	N/A	967	1,933	767
Annual Fuel Oil Use (gal)	N/A	9,073	18,146	7,201
Annual Fuel Oil Cost ($)	N/A	6,623	13,247	5,257
Steam System				
Fuel Oil Use (gal)	270,658	270,658	277,725	273,462
Electricity Use (kWh)	221,383	221,383	221,383	221,383
Electric Demand (kW)	4	4	4	4
Fuel Oil Cost ($)	197,580	202,739	202,739	199,627
Electricity Cost ($)	17,636	17,636	17,636	17,636
O&M Cost ($)	178,360	178,360	178,360	178,360
Total Steam Cost ($)	393,576	393,576	398,735	395,623
Water System				
Water Use (gal)	996,820	20,312,620	9,275,020	3,285,000
Electricity Use (kWh)	40,336	821,934	375,306	132,925
Electric Demand (kW)	-	-	-	-
Electricity Cost ($)	2,868	9,451	26,684	9,451
O&M Cost ($)	57,330	35,035	35,035	35,035
Chlorination Costs ($)	-	272	272	272
Total Water Cost ($)	60,198	93,747	61,991	44,758
Sewer System				
Effluent (gal)	816,163	816,163	816,163	816,163
Electricity Use (kWh)	-	-	-	-
Electric Demand (kW)	-	-	-	-
Electricity Cost ($)	-	-	-	-
O&M Cost ($)	19,110	19,110	19,110	19,110
Chlorination Costs ($)	-	-	-	-
Total Sewer Cost ($)	19,110	19,110	19,110	19,110
Total Utilities				
Fuel Oil Use (gal)	270,658	270,658	277,725	273,462
Electricity Use (kWh)	261,718	1,043,317	596,689	354,308
Electric Demand (kW)	4	4	4	4
Electricity Cost ($)	20,504	76,075	44,320	27,087
Fuel Oil Cost ($)	197,580	197,580	202,739	199,627
O&M Cost ($)	254,800	232,777	232,777	232,777
Total Utilities Cost ($)	**472,884**	**506,432**	**479,836**	**459,491**

6. LIFE CYCLE COST ANALYSIS

6.1 METHODOLOGY

The Life Cycle Cost Analysis (LCCA) methodology used in this study comprised a present value analysis of capital costs, operational costs, and projected energy costs over a 20 year life cycle. Uniform present value (UPV) factors and escalation rates for energy costs were taken from Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis 1996, which is the current update to NIST Handbook 135. A 4.1% discount rate was used for the purpose of this study in compliance with FEMP guidelines.

6.2 LCCA RESULTS

Table 6-1 on the following page summarizes the life cycle cost analysis for the baseline and options. The option with the least life cycle cost, and the recommended option, is the mixed utilities system option: water heating, circulation to drain, and pipe insulation because of its superior reliability.

Table 6-1. Life Cycle Cost Analysis

		Central Plant Options				Mixed Utility Options		
	Baseline	Abandoned Buildings at 45 F	Abandoned Buildings No Heat	Abandon Selected Utilidors	Distributed Utilities	Water Flow Only	Water Flow & Heating	Water Flow, Heating & Pipe Insulation
Investment Costs								
Distributed Steam Boilers					778,779	778,779	778,779	778,779
Boiler Fuel Systems					388,761	388,761	388,761	388,761
Water Wells & Fire Cisterns					1,039,861			
Septic Systems					667,277	667,277	667,277	667,277
Water Distribution Heater					-		19,800	19,800
Water Pipe Insulation							-	143,267
Total Construction Cost ($)	-	-	-	-	2,874,678	1,834,817	1,854,617	1,997,884
SIOH (5.5%)	-	-	-	-	158,107	100,915	102,004	109,884
Design (6%)	-	-	-	-	172,481	110,089	111,277	119,873
Total Investment Cost ($)	-	-	-	-	3,205,266	2,045,821	2,067,898	2,227,641
Annual Operating Costs	-	-	-	-	-	-	-	-
Electricity Cost ($)	86,654	49,836	48,831	48,831	20,504	76,075	44,320	27,087
Fuel Oil Cost ($)	1,307,783	733,974	391,525	289,617	197,580	197,580	202,739	199,627
O&M Cost ($)	1,027,246	892,491	892,491	892,491	254,800	232,777	232,777	232,777
Total Utilities Cost ($)	2,421,683	1,676,301	1,332,847	1,230,939	472,884	506,432	479,836	459,491
Life Cycle Costs								
Investment	-	-	-	-	**3,205,266**	**2,045,821**	**2,067,898**	**2,227,641**
Electricity	1,253,887	721,131	706,591	706,591	296,687	1,100,809	641,310	391,944
Fuel Oil	22,245,394	12,484,896	6,659,846	4,926,383	3,360,839	3,360,839	3,448,590	3,395,660
O&M	13,837,000	12,021,849	12,021,849	12,021,849	3,432,156	3,135,506	3,135,506	3,135,506
Total Life Cycle Cost ($)	**37,336,282**	**25,227,876**	**19,388,286**	**17,654,823**	**10,294,947**	**9,642,975**	**9,293,304**	**9,150,752**

6.3 PROJECT ECONOMICS

This section presents the economic analysis of implementing the distributed utilities option as a project. Operation of existing central utilities would require little capital investment, but would incur higher than necessary operating costs. The recommended mixed utility option would require a large capital investment, but would operate more efficiently. The ECIP economic evaluation form on the following page evaluates the economics of the recommended mixed utility option relative to the most cost effective central utility option.

The results of the ECIP evaluation are a 3.1 year simple economic payback and a Savings-to-Investment Ratio (SIR) of 4.5.

1. COMPONENT	MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		Dec-95
3. INSTALLATION AND LOCATION	Ft. Greely, Alaska	
4. PROJECT TITLE	Convert Existing Central Utilities to Distributed Utilities	5. PROJECT NUMBER

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Greely, Alaska REGION: 4 PROJECT NO: 1413-001
PROJECT TITLE: Replace Central Utilities with Distributed Utilities FISCAL YEAR: 1995
DISCRETE PORTION NAME: TOTAL
ANALYSIS DATE: 03/25/96 ECONOMIC LIFE 20 PREPARED BY: D Jones

1.	INVESTMENT				
	A. CONSTRUCTION COST	=	=	$1,997,884	
	B. SIOH COST	(5.5% of 1A) =		$109,884	
	C. DESIGN COST	(6.0% of 1A) =		$119,873	
	D. TOTAL COST	(1A +1B +1C) =		$2,227,641	
	E. SALVAGE VALUE OF EXISTING EQUIPMENT =				
	F. PUBLIC UTILITY COMPANY REBATE =				
	G. TOTAL INVESTMENT	(1D -1E -1F) =		——>	$2,227,641

2. ENERGY SAVINGS (+) OR COST (-):
DATE OF NISTR-4942-1 USED FOR DISCOUNT FACTORS: OCT '94

	ENERGY SOURCE	FUEL COST	ENERGY SAVINGS	SAVINGS (MBtu)	ANNUAL $ SAVINGS	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECTRICITY	$0.0711 ($/kWh)	(418,883) kWh	(1,430)	($29,783)	14.47	($430,954)	
B.	DIST	0.73 ($/gal)	126,078 gal	16,959	$92,037	17.01	$1,565,545	
C.	NAT GAS							
D.	REFUS							
E.	COAL							
F.	OTHER							
G.	ELEC DEMAND	75.00 ($/kW)	34 kW		$2,563	14.47	$37,090	
H.	TOTAL				$64,817		——>	$1,171,680

3.	NON-ENERGY SAVINGS (+) OR COST (-)				
	A. ANNUAL RECURRING (+/-)			$ 659,714	
	1 DISCOUNT FACTOR		(From Table A) =	13.47	
	2 DISCOUNTED SAVINGS (+) / COST (-)		(3A x 3A1) =		$8,886,343
	B. NON-RECURRING (+/-)				

ITEM	SAVINGS (+) COST(-) (1)	YEAR OF OCCURRENCE (2)	DISCOUNT FACTOR (3) (TABLE B)	DISCOUNTED SAVINGS/COST (4)
a.				
b.				
c.				
d. TOTAL				

C.	TOTAL NON-ENERGY DISCOUNTED SAVINGS (+) OR COST (-)	(3A2 + 3Bd4) =	$8,886,343
4.	FIRST YEAR DOLLAR SAVINGS (+) / COSTS (-)	(2H3+3A+(3Bd1/Economic Life))	$724,531
5.	SIMPLE PAYBACK (SPB) IN YEARS (MUST BE < 10 YEARS TO QUALIFY)	(1G/4) =	3.07
6.	TOTAL NET DISCOUNTED SAVINGS	(2H5 + 3C) =	$10,058,023
7.	DISCOUNTED SAVINGS-TO-INVESTMENT RATIO (SIR) (MUST HAVE SIR > 1.25 TO QUALIFY)	(6/1G) =	4.52

7. SUMMARY AND RECOMMENDATIONS

7.1. SUMMARY

The following utility options were analyzed:

- **Baseline.** The baseline reflects the current operating costs of the utilities at existing operational levels.

- **Reduced Central Utilities with Abandoned Buildings Heated to 45°F.** This option assumes continued operation of the central utilities to serve active buildings and to provide heat to utilidors and abandoned buildings to prevent deterioration.

- **Reduced Central Utilities with Abandoned Buildings Not Heated.** This option assumes continued operation of the central utilities to serve active buildings and to provide heat to utilidors to prevent freezing of water and sewer pipes.

- **Reduced Central Utilities Serving Only Active Buildings and Selected Utilidors.** This option assumes continued operation of the central utilities to serve active buildings and to provide heat to only those utilidors serving the active buildings. Steam, water, and sewer pipes in inactive utilidors would be isolated and drained. Fire hydrants served by inactive utilidors would not be operational.

- **Distributed Utilities.** This option would provide individual boilers, wells, and septic systems for each individual active building. All utilidors and existing fire hydrants would be abandoned. Underground cisterns for fire protection would be provided in selected locations.

- **Mixed Utilities.** This option combined distributed heating and sewer systems with a central water system. Three options for freeze protection were evaluated:

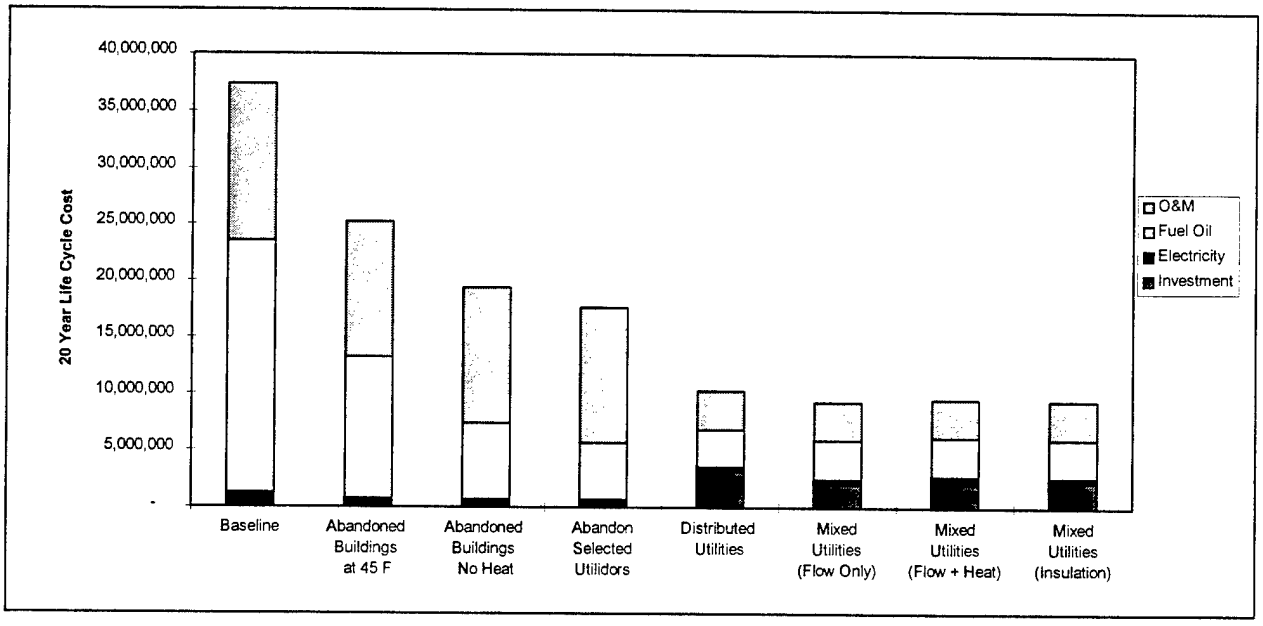
    1. **Circulation to Drain.** This option maintained water distribution temperatures above 28°F.

    2. **Heating and Circulation to Drain.** This option heated water entering the distribution system to 60°F and maintained water temperatures above 32°F.

    3. **Heating, Circulation to Drain, and Pipe Insulation.** This option insulated water pipes, heated water entering the distribution system to 60°F, and maintained water temperatures above 32°F.

Figure 7-1 below presents the results of the life cycle analysis.

Figure 7-1. Graphical LCCA



7.2. RECOMMENDATIONS

The mixed utilities option with potable water freeze protection by water heating, circulation to drain, and pipe insulation is recommended. The following modifications are required:

- The central steam plant would be abandoned.
- Each remaining active building should be fitted with a steam boiler and fuel oil tank. Existing HVAC and DHW heating equipment in each building should be connected to the new steam source.
- Each remaining active building should be fitted with a septic tank and drain field.
- The portion of the existing central water system serving active buildings should be retained. The existing well and storage tanks within the central steam plant should be retained. Freeze protection should be provided for the central water system in the form of water heating, circulation to drain, and pipe insulation. Water flow for freeze protection would be recycled to the earth through the proposed septic system.

It should be noted that fire hydrants near active buildings will still be functional, but fire hydrants in the vicinity of abandoned buildings will not.

The cost of the above modifications is estimated at $2,227,641. Economic comparison of the recommended option to the most cost effective central plant option indicates a 3.1 year simple economic payback and a Savings-to-Investment Ratio (SIR) of 4.5.

APPENDIX A

SCOPE OF WORK AND CONFIRMATION NOTICES

AUG 1995

CENPA-EN-TE-DM

SCOPE OF WORK

ENERGY EFFICIENCY STUDY

FOR

FORT GREELY

ALASKA

Performed as part of the

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

GENERAL SCOPE OF WORK
CONTRACT NO. DACA85-94-C-0033
Delivery Order No. 0003

ENERGY EFFICIENCY STUDY
FORT GREELY, AK
performed as part of the
ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

TABLE OF CONTENTS

ANNEXES

1.0 BRIEF DESCRIPTION OF WORK: The Architect-Engineer (A/E) shall:

1.1. Perform a limited site survey of specific buildings or areas to collect all data required to evaluate the specific ECOs included in this study.

1.2. Provide project documentation for recommended ECOs as detailed herein.

1.3. Prepare a comprehensive report to document all work performed, the results and all recommendations.

2.0 GENERAL:

2.1. This study is limited to the evaluation of the specific buildings, systems, or ECOs listed in the DETAILED SCOPES OF WORK, Annexes A and D.

2.2. The information and analysis outlined herein are considered to be minimum requirements for adequate performance of this study.

2.3. For the buildings, systems or ECOs listed in Annex A, all methods of energy conservation which are reasonable and practical shall be considered, including improvements of operational methods and procedures as well as the physical facilities. All energy conservation opportunities which produce energy or dollar savings shall be documented in this report. Any energy conservation opportunity considered infeasible shall also be documented in the report with reasons for elimination.

2.4. The study shall consider the use of all energy sources applicable to each building, system, or ECO.

2.5. The "Energy Conservation Investment Program (ECIP) Guidance", establishes criteria for ECIP projects and shall be used for performing the ecomonic analyses of all ECOs and projects. A computer program, Life Cycle Cost In Design (LCCID), has been developed for performing life cycle cost calculations in accordance with ECIP guidelines and is referenced in the ECIP Guidance. This program is available commercially from the BLAST Support Office in Urbanna, Illinois. The BLAST Support Office can be contacted at 1-800-842-5278. The latest version of the program should be used. If any program other than LCCID is proposed for life cycle cost analysis, it must use the mode of calculation specified in the ECIP Guidance. The output must be in the format of the ECIP LCCA summary sheet, and it must be submitted for approval prior to use.

2.6 Energy conservation opportunites determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar ECOs into larger packages which will qualify for ECIP or MCA funding, and determining in coordination with installation personnel the appropiate packaging and implementation approach for all feasible ECOs.

3.0 PROJECT MANAGEMENT:

3.1. Project Managers:

3.1.1 Project Manager: The A/E shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. This designated individual shall be responsible for coordination of work required under this contract.

3.1.2 Design Manager: The Contracting Officer will designate a design manager to serve as the Government's point of contact and liaison for all work required under this contract.

3.2. Installation Assistance: The Director of Public Works or authorized representative will designate an individual to assist the A/E in obtaining information and establishing contacts necessary to accomplish the work required under this contract.

3.3. Public Disclosures: The A/E shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.4. Meetings: Meetings will be scheduled whenever requested by the A/E or the Design Manager for the resolution of questions or problems encountered in the performance of the work. The A/E's project manager and the design manager shall be required to attend and participate in all meetings pertinent to the work required under this contract. These meetings, if necessary, are in addition to the presentation and review conferences.

3.5. Site Visits, Inspections, and Investigations: The A/E shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

3.6. Conferences and Confirmation Notices:

3.6.1. The A/E shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the A/E and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. the A/E shall forward to the Design Manager within ten calendar days, a reproducible copy of the records.

3.6.2. The A/E shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The A/E shall forward to the Design Manager within ten calendar days, a reproducible copy of the record of request or receipt of material.

3.6.3. A review conference will be scheduled approximately 28 days after submittals. Review comments will be provided at this conference. These comments will become part of the conference minutes forwarded to the A-E and annotated with conference action. Review comments provided to the A-E will not necessarily show coordination requirements with other parts of the

submittal. The A-E shall incorporate the review comments into each part of the submittal as necessary.

3.7. Interview: The A/E shall conduct entry and exit interviews with the Director of Public Works or designated representative before starting work at the installation and after completion of the field work. The Design Manager shall schedule the interviews at least one week in advance and shall be in attendance.

3.7.1. Entry: The entry interview shall describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

a. Schedules
b. Names of energy analysts who will be conducting the site survey.
c. Proposed working hours.
d. Support requirements from the Directorate of Public Works.

3.7.2. Exit: The exit interview shall be conducted when the field work is complete and briefly describe the items surveyed and probable areas of energy conservation.

4.0 SERVICES AND MATERIALS: All services, materials (except those specifically enumerated to be furnished by the Government), plant, labor, supervision and travel necessary to perform the work and render the data required under this contact are included in the lump sum price of the contract.

5.0 PROJECT DOCUMENTATION: All energy conservation opportunities which the A/E has considered shall be included in one of the following categories and presented in the report as such:

5.1. ECIP Projects: To qualify as an ECIP Project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than $300,000. The overall project and each discrete part of the project shall have an SIR greater than 1.25. Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Saving to Investment Ratio (SIR). Programming documentation shall consist of a DD Form 1391, life cycle cost analysis (LCCA) summary sheet(s) (with necessary backup data to verify the numbers presented), and a Project Development Brochure (PDB). A life cycle cost analysis summary sheet shall be developed for each ECO and for the overall project when more than one ECO are combined. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs.

5.2. NON-ECIP Projects: Projects which do not meet ECIP criteria, but which have an SIR greater than 1.25 shall be documented and ranked in order of highest to lowest SIR. Projects or ECOs shall be provided with the following documentation: the life cycle cost analysis (LCCA) summary sheet completely filled out; a description of the work to be accomplished; backup data for the LCCA, ie; energy savings calculations and cost estimate(s); and the simple payback period. The energy savings for projects consisting of multiple ECOs must take into account there synergistic effects of the individual ECOs. In addition these projects shall have the necessary documentation prepared, as required by the Government's representative, for one of the following categories:

a. Regular Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than $300,000.00 and a simple payback period of ten to twenty-five years. Documentation shall consist of DD Form 1391 and a Project Development Brochure.

b. Low Cost/No Cost Projects. These are projects which the Directorate of Public Works (DPW) can perform using its resources. Documentation shall be as required by DPW.

5.3. Nonfeasible ECOs: All ECOs which the A/E has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

6.0 DETAILED SCOPE OF WORK: The Detailed Scope of Work is contained in Annex A and Annex D.

7.0 WORK TO BE ACCOMPLISHED:

7.1. Review Previous Studies: Not Used.

7.2. Perform a Limited Site Survey: The A/E shall obtain all necessary data to evaluate the ECOs or projects by conducting a site survey. The A/E shall document his site survey on forms developed for the survey, or standard forms, and submit these completed forms as part of the report. All test and/or measurement equipment shall be properly calibrate prior to its use.

7.3. Revaluate Selected Projects: Not Used.

7.4. Evaluate Selected ECOs: As described in Detailed Scope of Work.

7.5. Combine ECOs Into Recommended Projects: At the interim review conference, the A/E will be provided direction of the packaging or the combining of ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. Some projects may be a combination of several ECO's, and others may contain only one.

7.6. Submittals: The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and shall be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. Names of the persons primarily responsible for the project shall be included.

7.6.1. Interim Submittal: An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings, SIR, and simple payback period of all the ECOs shall be included. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound separately in a

standard three-ring binder. The A/E shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. The final report and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly.

7.6.2. Final Submittal: The A/E shall prepare and submit the final report when all sections of the report are 100% complete and all comments from the interim submittal have been resolved. The A/E shall submit the Scope of Work for the study and any modifications to the scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The recommended projects, as determined in accordance with paragraph 5, shall be presented in order of priority by SIR. The final report and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The final report shall be arranged to include:

a. An Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See Annex B for minimum requirements).

b. The narrative report describing the problem to be studied, the approach to be used, and the results of this study.

c. Documentation for the recommended projects (includes LCCA Summary Sheets).

d. Appendices to include as a minimum:

1) Energy cost development and backup data
2) Detailed calculations
3) Cost estimates
4) Computer printouts (where applicable)
5) Scope of Work

7.7 Presentation: The A/E shall give a formal presentation of the interim submittal to the installation, command, and other Government personnel. Slides or view graphs showing the results of the study to date shall be used during the presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. The presentation will be conducted the same day as the review conference.

ANNEX A

DETAILED SCOPE OF WORK (REVISED)
CONTRACT NO. DACA85-94-D-0033
Delivery Order No. 0003

ENERGY EFFICIENCY STUDY (POWER DISTRIBUTION)
FORT GREELY, ALASKA

1.0 General Information:

1.1 The Architect-Engineer (A-E) shall furnish all services, materials, supplies, labor, equipment, investigations, studies, supervision and travel as required in connection with this Statement of Work (SOW), and all furnished and referenced instructions.

1.1.1 This SOW is organized as follows:

Paragraph TOPIC:

1.0 General Information
2.0 Project Criteria
3.0 Cost and Scope Limitations
4.0 Delivery Schedule
5.0 Architect Engineer Services
6.0 Initiation Of Work
7.0 Government Review
8.0 Travel
9.0 Submittals

1.1.3 Project Description: The AE will be required to conduct a limited site survey, evaluate energy savings, construction costs, and the cost to savings ratio associated with converting the existing power distribution system from 2400 volts, 3-wire ungrounded Delta to a 4-wire system. The AE shall investigate the existing system, and prepare a comprehensive report documenting all work performed, the results and recommendations. See Annex D for list of buildings and linear feet of utilities to remain active after base realignment.

The investigation is to include but not limited to: Insulators, crossarm condition, pole condition, wire size, wire material, wire connectors and transformers. Begin at the output of the Golden Valley Electric Association Transformed into the power plant and out through the distribution system. There are approximately 35 miles of overhead distribution system. Single line drawings of the distribution system resulting from a recent short circuit study and feeder and transformer data are at Enclosure 1.

1.1.4 Point of Contact: The Design Manager for this project is Mr. Ron Cothren and the Contracting Officer's Representative is Mr. Claude Vining and the ACOR is Mrs. Trillis Enders. The Point of Contact at Fort Greely is Mr. Mike Murphy.

2.0 Project Criteria:

2.1 Government Furnished Materials and Equipment:

a. US Army Corps of Engineers, Architectural and Engineering Instructions - Design Criteria, 9 December 1991.

b. Energy Conservation Investment Program (ECIP) Guidance, dated 10 Jan 1994.

c. TM5-785, Engineer Weather Data

d. AR 420-49, Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems.

e. Tri-Service Military Construction Program (MCP) Index, dated 4 January 1994.

f. MCACES-Gold cost estimating guidance, program and database, diskettes, and licensing agreement.

2.2.1 Review Previous Studies: Previous EEAP studies do not cover power distribution.

3.0 Cost and Scope Limitations:

3.1 Cost Limitation: The construction cost limitation for this project is undefined. The AE will be responsible for developing the cost based upon the scope constraints for this project.

3.2 Cost Estimate:

3.1.2 Cost Estimate Format: Cost estimates shall be prepared using the latest version of Micro Computer Aided Cost Engineering System (MCACES)-GOLD, Version 5.20J or greater, with the appropriate labor equipment and material data bases. MCACES-GOLD will be provided to the A-E by the Cost Engineering Branch of the Alaska District Corps of Engineers at no cost. Upon completion of the contract, the A-E will return all material to the Government. The Alaska District is using a Standardized Work Breakdown Structure (WBS) for all military and civil work cost estimates. Corps format for cost estimates will be made available for use on other cost estimate requirements.

4.0 Delivery Schedule: The work, other related data, and services required in accordance with the contract shall be accomplished within the limitation of projects scope. The schedule for delivery of data to the Contracting Officer is in calendar days. Calendar days for each requirement extend from the date of the Notice to Proceed (NTP) or approval for each item, except as otherwise noted.

	Item	Schedule	DeliveryReview/Conference Time/Location
(a)	Start Project: Interviews and Site Survey	30 days following NTP	Not Required
(b)	Interim Submittal	90 days following NTP	28 days / Post
(c)	Final Submittal	21 days following Interim Rev. Conf.	Not required

5.0 Architect-Engineer Services:

5.1 Interim Submittal: The interim submittal shall fulfill the requirements of the paragraph 7.6.1 of the General Scope of Work.

5.2 Final Submittal: The final submittal shall fulfill the requirements of paragraph of the General Scope of Work. The A-E shall incorporate all interim review conference comments. The Government may back-check all documents which comprise this submittal. The documents, if found incomplete, shall be returned to the A-E for further work which shall be performed at no additional cost to the Government.

6.0 Initiation of Work:

The AE shall not proceed nor initiate any work nor any succeeding design level of the work required under this SOW prior to receipt of award. Any work done without being directed to do so by the Contracting Officer/authorized representative shall be at the AE's own risk.

7.0 Government Review:

7.1 Value Engineering: Not Used.

7.2 Review: The Contracting Officer or his authorized representative may furnish the AE review comments on the data submitted. The AE shall incorporate all accepted review comments in the development of data for the next submittal. The AE will not be required to incorporate comments that may be categorized as "designer preference." If any review comment requires clarification and/or amplification to assure compliance, the AE shall notify the Contracting Officer or his authorized representative in writing.

8.0 Travel:

Out of town travel is anticipated to Fort Greely at Delta Junction, Alaska.

9.0 Submittals:

All submittals shall be received at the Alaska District Engineer Offices, Design Management Section, Military Technical Engineering Branch in accordance with the design schedule in Section 4.0 above.

9.1 A dated submittal letter shall be provided with each submittal to the Contracting Officer with distribution to agencies listed. This letter shall indicate to whom and the number of copies to be mailed to the agencies listed via overnight, hand, or telefax delivery service by the AE.

9.2 The A/E shall make direct distribution of correspondence, minutes, report submittals, and responses to comments as indicated by the following schedule:

AGENCY	EXECUTIVE SUMMARIES	REPORTS	CORRESPONDENCE	FIELD NOTES
Commander, 6th Infantry Division (Light) ATTN: APVR-FG-PW (Murphy) P.O. Box 1289, Delta Junction, AK 99737	7	7	1	1*
Commander, 6th Infantry Division (Light) ATTN: APVR-PW-O (Berg) Building 730, Fort Richardson, AK 99505-5500	3	3	1	-
Commander, USAED, Mobile ATTN: CESAM-EN-DM (Battaglia) P.O. Box 2288, Mobile, AL 36628-0001	1	1	1	-
Commander, USAED, Alaska ATTN: CENPA-EN-TE-DM (Piening) P.O. Box 898, Anchorage, AK 99506-0898	7	7	7	1*
Commander, USAED, Alaska ATTN: CENPA-CO-FR (Shuman) P.O. Box 35066, Fort Wainwright, AK 99703-0066	1	1	1	-
Commander, North Pacific Division ATTN: CENPD-PE-TE (Pinkham) P.O. Box 2870, Portland, OR 97208-2870	1	1	-	-
Commander, US Army Logistics Evaluation Agency ATTN: LOEA-PL (Mr. Keath) New Cumberland Army Depot New Cumberland, PA 17070-5007	1	-	-	-
Commander, US Army Corps of Engineers ATTN: CEMP-ET (Mr. Gentil) 20 Massachussetts Avenue, NW Washington, DC 20314-1000	1	-	-	-

* Field Notes Submitted in final form at interim submittal

PIENING\re\x1600\ARMY\FTW141\DAVE
4 Aug 94

ANNEX B

EXECUTIVE SUMMARY GUIDELINE

1. Introduction.

2. Building Data (types, number of similar buildings, sizes, etc.)

3. Present Energy Consumption of Buildings or Systems Studied.

   - Total Annual Energy Used.

   - Site Energy Consumption.

     Electricity - KWH, Dollars, BTU
     Fuel Oil - GALS, Dollars, BTU
     Natural Gas - THERMS, Dollars, BTU
     Propane - GALS, Dollars, BTU
     Other - QTY, Dollars, BTU

4. Energy Conservation Analysis.

   - ECOs Investigated.
   - ECOs Recommended.
   - ECOs Rejected. (Provide economics or reasons).
   - ECIP Projects Developed. (Provide list)*
   - Non-ECIP Projects Developed. (Provide list)*
   - Operational or Policy Change Recommendations.

* Include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date.

5. Energy and Cost Savings.

   - Total Potential Energy and Cost Savings resulting from recommended projects in MBTU/yr and $K/yr.

   - Percentage of Energy Conserved

   - Energy Use and Cost Before and After the Energy Conservation Opportunities are Implemented.

ANNEX C

REQUIRED DD FORM 1391 DATA

To facilitate ECIP project approval, the following supplemental data shall be provided:

a. In title block clearly identify projects as "ECIP."

b. Complete description of each item of work to be accomplished including quantity, square footage, etc.

c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).

d. List references, and assumption, and provide calculations to support dollar and energy savings, and indicate any added costs.

(1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage, floor area, window and wall area for each exposure.

(2) Identify weather data source.

(3) Identify infiltration assumptions before and after improvements.

(4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.

e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operations and future expected efficiency. if full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.

f. AN ECIP life cycle cost analysis summary sheet as shown in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.

g. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement

attesting that all buildings and retrofit actions will be in active use throughout the amortization period.

h. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.

i. For each temporary building included in a project, separate documentation is required showing (1) a minimum 10-year continuing need, based on the installation's annual real property utilization survey, for active building retention after retrofit, (2) the specific retrofit action applicable and 93) an economic analysis supporting the specific retrofit.

j. Nonappropriated funded facilities will not be included in an ECIP project without an accompanying statement certifying that utility costs are not reimbursable.

k. Any requirements required by ECIp guidance dated 4 Nov 1992 and any revisions thereto. Note that unescalated costs/savings are to be used in the economic analyses.

l. The five digit category number for all ECIP projects except for Family Housing is 80000. The category code number for Family Housing projects is 71100.

ANNEX D

DETAILED SCOPE OF WORK (REVISED)
CONTRACT NO. DACA85-94-D-0033
Delivery Order No. 0003

ENERGY EFFICIENCY STUDY (STEAM, WATER, SANITARY SEWER)
FORT GREELY, ALASKA

1.0 GENERAL INFORMATION

1.1 The Architect-Engineer (AE) shall furnish all services, materials, supplies, labor, equipment, investigations, studies, supervision and travel as required in connection with this Statement of Work (SOW), and all furnished and referenced instructions.

1.1.1 This SOW is organized as follows:

Paragraph TOPIC:

1.0 General Information
2.0 Project Criteria
3.0 Initiation Of Work
4.0 Government Review
5.0 Travel
6.0 Schedule and Submittal Requirements
7.0 Payment Schedule

1.1.2 Project Description: The purpose of the Energy Efficiency Study is to identify modifications necessary to provide the most energy efficient configuration of utilities to serve the designated active buildings at Fort Greely following implementation of the base realignment plan. Currently the buildings at Fort Greely are served by a central electric distribution system, central steam system, central potable water system, and a central sewer system. Much of these central systems are near the end of their useful lives. With the abandoning of most buildings, the existing utilities will likely be grossly over sized and operate with poor energy efficiency and high maintenance costs. This study is to evaluate the following configurations for each utility:

a. Modification of central systems to serve remaining designated active buildings.

b. Installation of separate utilities to serve each designated active building or group of buildings.

The contractor will be required to evaluate the central steam, potable water, and sanitary sewer systems and determine if the systems are adequate to serve the buildings and associated utilidors designated in the Fort Greely Realignment Plan (see Active Building List below) that are to remain active. In evaluating the present system, the contractor shall complete a energy survey and provide a plan that will provide the greatest energy efficiency.

There are currently 231 buildings located on Fort Greely, consisting of 1,699,787 sq. ft. of space. the majority of which will be "laid-away" under the Layaway Program for disposition or eventual demolition. Of these 231 buildings, the tollowing have been identified for retention to support the residual force to be left at Fort Greely. The following tables are from a draft of the IMPLEMENTATION PLAN FOR REALIGNMENT OF FORT GREELY as provided by Mr. Mike Murphy, Dept. of Public Works, Ft. Greely, Alaska:

Permanent Active Facility List as of 25 JUL 95

Bldg No.	Description	Location	Size (SF)
110	POL Monitoring	North Post	382
501	HQ	Cantonment	19,095
504	Fire Station	Cantonment	6,192
605	Consolidated PW	Cantonment	24,915
606	Central Heat Plant	Cantonment	30,334
607	Heat Plant Annex	Cantonment	999
615	Roads and Grounds	Cantonment	17,351
617	POL Operation	Cantonment	448
618	POL Operation	Cantonment	621
633	Sewage Treatment	Cantonment	2,784
638	Sewage Lagoon	Cantonment	742
639	Contact Chamber	Cantonment	696
820	Unacc Pers Hsg	Cantonment	16,175
821	Unacc Pers Hsg	Cantonment	16,175
503	Gym w/o Pool	Cantonment	22,430
725	State School	Cantonment	0 (Non-Army)
1928 & 1930	CRTA Complex	Bolio Lake	35,061
2013, 2019, 2026	NWTC Complex	Black Rapids	39,218
1600, 1605, 1606	Range	Texas Range	6,211
1343, 1350, 1352	Range	Beales Range	4,968
1419	Range	Mississippi Range	960
		TOTAL	245,937

Real Property Utilities

Category	Before	After
Overhead Electric	31.2 Miles	23.1 Miles
Underground Electric	10.7 Miles	3.4 Miles
Steam/Condensate Lines	57,000 LF	5,700 LF
Water Lines	40,000 LF	5,700 LF
Sewer Lines	45,000 LF	7,700 LF
Utilidors	17,600 LF	5,550 LF

1.1.3 Points of Contact: The Design Manager for this project is Mr. Ron Cothren and the Contracting Officer's Representative is Mr. Claude Vining and the ACOR is Mrs. Trillis Enders. The Point of Contact at Fort Greely is Mr. Mike Murphy.

2.0 PROJECT CRITERIA

2.1 Government Furnished Materials and Equipment:

a. US Army Corps of Engineers, Architectural and Engineering Instructions - Design Criteria, 9 December 1991.
b. Energy Conservation Investment Program (ECIP) Guidance, dated 10 Jan 1994.
c. TM5-785, Engineer Weather Data
d. AR 420-49, Heating, Energy Selection and Fuel Storage, Distribution, and Dispensing Systems.
e. Tri-Service Military Construction Program (MCP) Index, dated 4 January 1994.
f. MCACES-Gold cost estimating guidance, program and database, diskettes, and licensing agreement.

2.2 Field Investigation

Conduct a survey of the existing central utilities and the buildings to remain under the Fort Greely realignment plan. Data collected for each utility should include, but not be limited to the following:

a. Present condition and expected life of the existing central distribution systems.
b. Modifications necessary to restrict central utility service only to designated active building and facilities.
c. Data necessary to determine costs associated with continued operation of central utility systems including modification costs, energy costs, and operating and maintenance (O & M) costs.
d. Data necessary to determine utility capacity requirements and energy consumption of each designated active building.
e. Modifications necessary to install separate utilities in individual buildings or groups of buildings.

2.3 Analysis

a. Operation of existing central systems with only those essential modifications required to serve the remaining designated active buildings. This option will serve as the baseline for Energy Conservation Oportunity (ECO) analysis.

b. ECO 1: Operation of existing central systems optimized to serve the remaining designated active buildings.

c. ECO 2: Installation of separate utilities (where practical) to serve each designated active building or group of buildings.

The A/E should identify the logical configuration of each utility for each of the above options and perform life cycle cost analysis (LCCA) including capital costs of required modifications, energy costs, and O & M costs.

Economic analysis should follow the criteria for the "Energy Conservation Program (ECIP) Guidance", described in letter from DAIM-FDF-U, dated 10 Jan 1994.

Computer modeling will be used to determine the annual energy costs for typical buildings. The results of these calculations may be applied to buildings which are similar to the typical buildings. To be considered similar, a building must have the same type of occupancy schedule, the same type of HVAC system, and the same type of construction. Modeling will be performed using a professionally recognized and proven computer program of programs that integrate architectural features with air-conditioning, heating, lighting,, and other energy-producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads of the building under study. The simulation programs acceptable for use in this study are listed below. Any substitutes must be submitted and approved by the COR.

A. Building Loads and System Thermodynamics (BLAST).
B. DOE 2.1d
C. Carrier E20 of Hourly Analysis Program (HAP)
D. Trane Air-Conditioning Economics (TRACE).
E. Beacon

3.0 INITIATION OF WORK

The AE shall not proceed nor initiate any work nor any succeeding design level of the work required under this SOW prior to receipt of award. Any work done without being directed to do so by the Contracting Officer/authorized representative shall be at the AE's own risk.

4.0 GOVERNMENT REVIEW:

4.1 Value Engineering: Not Used.

4.2 Review: The Contracting Officer or his authorized representative may furnish the AE review comments on the data submitted. The AE shall incorporate all accepted review comments in the development of data for the next submittal. The AE will not be required to incorporate comments that may be categorized as "designer preference." If any review comment requires clarification and/or amplification to assure compliance, the AE shall notify the Contracting Officer or his authorized representative in writing.

5.0 TRAVEL

Out of town travel is anticipated to Fort Greely at Delta Junction, Alaska.

6.0 SCHEDULE AND SUBMITTAL REQUIREMENTS

Submittal	Schedule
Pre-Final Report	120 days from NTP
Review Conference	30 days after Pre-Final submittal
Final Report	30 days from review conference

6.1 A dated submittal letter shall be provided with each submittal to the Contracting Officer with distribution to agencies listed. This letter shall indicate to whom and the number of copies to be mailed to the agencies listed via overnight, hand, or telefax delivery service by the AE.

6.2 The A/E shall make direct distribution of correspondence, minutes, report submittals, and responses to comments as indicated by the following schedule:

AGENCY	EXECUTIVE SUMMARIES / REPORTS / CORRESPONDENCE / FIELD NOTES			
Commander, 6th Infantry Division (Light) ATTN: APVR-FG-PW (Murphy) P.O. Box 1289, Delta Junction, AK 99737	7	7	1	1*
Commander, 6th Infantry Division (Light) ATTN: APVR-PW-O (Berg) Building 730, Fort Richardson, AK 99505-5500	3	3	1	-
Commander, USAED, Mobile ATTN: CESAM-EN-DM (Battaglia) P.O. Box 2288, Mobile, AL 36628-0001	1	1	1	-
Commander, USAED, Alaska ATTN: CENPA-EN-TE-DM (Piening) P.O. Box 898, Anchorage, AK 99506-0898	7	7	7	1*
Commander, USAED, Alaska ATTN: CENPA-CO-FR (Shuman) P.O. Box 35066, Fort Wainwright, AK 99703-0066	1	1	1	-
Commander, North Pacific Division ATTN: CENPD-PE-TE (Pinkham) P.O. Box 2870, Portland, OR 97208-2870			1	1 - -
Commander, US Army Logistics Evaluation Agency ATTN: LOEA-PL (Mr. Keath) New Cumberland Army Depot New Cumberland, PA 17070-5007	1	-	-	-
Commander, US Army Corps of Engineers ATTN: CEMP-ET (Mr. Gentil) 20 Massachussetts Avenue, NW Washington, DC 20314-1000	1	-	-	-

* Field Notes submitted in Final Form at interim submittal

PIENING\re\x1600\ARMY\FTG058\ANNEXD.FTG 2 Aug 95

EMC ENGINEERS, INC.

2750 South Wadsworth Blvd. • Suite C-200
Denver, Colorado 80227-3400
303/988-2951 • Fax: 303/985-2527

CONFIRMATION NOTICE

Confirmation Notice No. 1 EMC #1406.003

DATE: 11 September 1995

PLACED TO: Dennis Jones / Fred Jones
RECEIVED FM: Dave Piening / Gary Creviston
REPRESENTING: U.S. Army, COE, Alaska District
PHONE: 907/753-5609

PROJECT: Energy Efficiency Study, Ft. Greely, AK
CONTRACT NO.: DACA01-94-D-0033, Delivery Order No. 003

NOTES Fred Jones,
PREPARED BY: E M C Engineers, Inc.

TIME & DATE 10:30 MST
OF TELECON: 11 September 1995

SUBJECT: Clarifications to SOW dated 1 August 1995

The following is a summary of the items discussed, the comments made, and the decisions made during the telephone conversation.

1. EMC will submit a combined report that includes the Energy Efficiency Studies for the Power, Steam, Water, and Sanitary Sewer Distribution Systems.

2. EMC will proceed with the study using the list of buildings to remain active as provided in the SOW dated 1 August 1995. If this list is changed significantly before the completion of the report and the results of the study are impacted, a change in the SOW will be issued.

3. EMC will use the distribution list from the original SOW dated 1 August 1994. Commander Pinkham will receive one copy of the report.

4. EMC will provide 23 copies each of the Pre-Final and Final reports.

5. EMC will address the fact that the base will not begin downsizing until 1997 and the downsizing will continue through 2000. The interim period between 1995 and 1997 will be discussed in the power distribution section of the study.

6. EMC will include the cost of having GVEA provide electric service to the buildings that will remain after the downsizing.

7. The submittal schedule will be the same as shown in Section 6.0, Page D-4 of the SOW dated 1 August 1995. For the sake of clarity, that schedule is as follows:

Submittal	Schedule
Pre-Final Report	120 days from NTP
Review Conference	30 days after Pre-Final Submittal
Final Report	30 days from review conference

/oic

Action Required: Issue Notice to Proceed.

cc: Dennis Jones
File

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

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CONFIRMATION NOTICE

Confirmation Notice No. 2 EMC #1406.003

DATE: 12 September 1995

PLACED TO: Dennis Jones
RECEIVED FM: Dave Piening
REPRESENTING: U.S. Army, COE, Alaska District
PHONE: 907/753-5609

PROJECT: Energy Efficiency Study, Ft. Greely, AK
CONTRACT NO.: DACA01-94-D-0033, Delivery Order No. 003

NOTES PREPARED BY: Fred Jones, E M C Engineers, Inc.

TIME & DATE OF TELECON: 16:45 MST 12 September 1995

SUBJECT: Clarifications to Confirmation Notice No. 1

The following is a summary of the items discussed, the comments made, and the decisions made during the telephone conversation.

1. EMC will submit two separate reports for the Energy Efficiency Study for Fort Greely Alaska. One report will be entitled "Energy Efficiency Study (Power Distribution), Fort Greely, Alaska. The other report will be entitled "Energy Efficiency Study (Steam, Water, Sanitary Sewer), Fort Greely, Alaska.

/oic

Action Required: Issue Notice to Proceed.

cc: Dennis Jones
Bill Center
File

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

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CONFIRMATION NOTICE

Confirmation Notice No. 3 EMC #1406.003

DATE: 8 December 1995

PLACED TO: Dave Piening
RECEIVED FM: Fred Jones
REPRESENTING: U.S. Army, COE, Alaska District
PHONE: 907/753-5609

PROJECT: Energy Efficiency Study, Ft. Greely, AK
CONTRACT NO.: DACA01-94-D-0033, Delivery Order No. 003

NOTES Fred Jones,
PREPARED BY: E M C Engineers, Inc.

TIME & DATE Approximately 11:00 MST
OF TELECON: 6 December 1995

SUBJECT: GVEA Letter

The following is a summary of the items discussed, the comments made, and the decisions made during the telephone conversation.

1. The letter to GVEA prepared by EMC for the purpose of ascertaining their interest in supplying electricity directly to the remaining buildings at Fort Greely after the realignment, has been forwarded to the appropriate contracts people for disposition. It is likely that an answer on this issue will not be back before the power distribution report submittal is due. If that is the case, the issue will be mentioned in the report only to the extent that it is another avenue that is being investigated.

2. It has not been determined yet whether the review meeting will be held in Delta Junction or Anchorage. Will confirm later.

/oic

Action Required: Issue Notice to Proceed.

cc: Fred Jones
Dennis Jones

Doug Gray
File

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

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CONFIRMATION NOTICE

Confirmation Notice No. 4 EMC #1406-003

DATE: 18 March 1996

PROJECT: Energy Efficiency Study Steam., Water and Sewer Systems
CONTRACT NO.: DACA01-94-D-0033, Delivery Order No. 003

NOTES PREPARED BY: Dennis Jones
E M C Engineers, Inc.

DATE OF MEETING: February 23, 1996

PLACE OF MEETING: U.S. Army Corps of Engineers, Alaska District
Anchorage, Alaska

SUBJECT: Preliminary Report Review Meeting, U.S. Army Corps of Engineers Alaska District, Anchorage, Alaska

ATTENDEES:
Dave Piening, COE Anchorage, AK
Paul Knoff, COE Anchorage, AK
Mike Murphy, Ft. Greely, AK
George Pursey, Fort Greely, AK
Fred Jones, EMC Denver, CO
Dennis Jones, EMC Denver, CO

The following is a summary of the items discussed, the comments made, and the decisions made during the meeting.

REVIEW COMMENTS

Robert S. Woodruff

1. **COMMENT:** General; Although the study is based around energy savings the fact that the fire protection water supply is being turned off along with the fact that unheated buildings deteriorate in just two years would seem more important that the energy savings involved. This should be emphasized in the final report.
   RESPONSE: The Executive Summary and Section 7 will be modified to emphasize these facts.

2. **COMMENT:** Page 2-4; The method used to calculate the amount of energy used for domestic hot water assumes that there is no heating load in July. Is this true?
   RESPONSE: No, July heating loads for the Fort were extrapolated from computer simulations at the school. The text on page 2-4 will be modified to explain more clearly.

3. **COMMENT:** Excellent study and report. The material was presented in a logical and understandable manner.
   RESPONSE: Thank You.

<u>Mike Murphy</u>

1. **COMMENT:** Executive Summary Recommendations; The method of water circulation of freeze protection is likely to fail due to frozen water pipes.
   RESPONSE: The more reliable alternative of water circulation with water heating and pipe insulation will be recommended.

2. **COMMENT:** Report 1.1 Authority for Study; Is the third sentence a correct portrayal of events or does it need to be re-phrased?
   RESPONSE: This paragraph will be rephrased to correctly identify the authority for the study.

3. **COMMENT:** Report 1.3 Scope of Work-Table 1-1; Gym with pool is 27430 s.f.; 725 (school) is 54,604 s.f. Add 612-Tank Maintenance-Containment-s.f. 18681, Add 658-Temp. Motor Pool-Containment-s.f. 25,425, Add 625-Pump House-Containment-s.f. 293 Note: 612, 658, 625 are served by central utilities. The total square footage served by central utilities is the relevant number for this study.
   RESPONSE: Building areas will be corrected as indicated.

4. **COMMENT:** Report 2.1.1 Description/Central South Heating System; Two of the original three 1954 Boilers were replaced in 1993. One original boiler remains in service system operates at 120 PSIG
   RESPONSE: Paragraph will be corrected.

5. **COMMENT:** Report 2.1 Figure 2-1 Utlidor System; Add Bldgs. 612, 658, & 625 as "Active Buildings"
   RESPONSE: Figure will be corrected.

6. **COMMENT:** Report 2.1.3 Energy Consumption/Space Heating; If current space heating requirements is used in this simulation, the school floor area should be corrected for 50,228 to 54,604 s.f. (8% difference).
   RESPONSE: School floor area will be corrected.

7. **COMMENT:** Report 2.2.1 Description/Central Water System-second paragraph; One other well for supplementing water supply-not four, well depth vary from 270' to 400'. Water table 200'+.
   RESPONSE: Paragraph will be corrected.

8. **COMMENT:** Report 2.3.1 Description/Central Sewer System-Third paragraph; A) The disinfecting chamber and the chlorinating facility are the same. B) The two effluent pumps run 3 to 4 hours/day each.
   RESPONSE: Section will be corrected.

9. **COMMENT:** Report 2.3.2 Energy Consumption; No stirrers in the system.
   RESPONSE: Stirrers will be dropped from text.

10. **COMMENT:** Report 3.4 Table 3-3: Total water cost all three options is $47,155.
    RESPONSE: Domestic water use and cost would remain constant because there is no one in the abandoned buildings to use water whether they are heated or not.

11. **COMMENT:** Report 4.1.1 Distribution Heating Systems-description; Change the two boilers each sized at 60% of peak demand at each building to two boilers each sized at 100% of peak demand. This changes the required boiler capacity listed in Table 4-1. (Capacity looks low even for 60%)
    RESPONSE: Text and cost estimate will be modified to reflect boilers sized at 100%.

12. **COMMENT:** Report 4.2.1 Distributed Water Systems-Description; Wells drilled to 250 feet will work; water table is at 180' to 200'+
    RESPONSE: Text and cost estimate will be modified.

13. **COMMENT:** Report 4.6 Implementation Costs-Table 4-4; A) Cost Shown for distributed steam boilers' is too low-per Appendix F, the $376,039 is total of boilers in seven buildings, (or is it two?) one each and assumed to be sized at 60% of peak demand. Need two boilers each sized at 100% at each building. Add boilers for 612 & 658. Also 501. B) Cost shown for "Boiler Fuel Systems" is too low-installed cost for 5000 gal. UST at Ft. Greely is $40,000. Installed cost for 1000 gal. UST at Ft. Greely is $21,000. Ft. Greely DPW would probably install 5000 gallon UST at most buildings, maybe two at 725 (school).
    RESPONSE: See Comment 11 above. Suggested costs for fuel tanks will be used. Fuel tank sizes will be re-evaluated.

14. **COMMENT:** Report 4.1.1 Distributed Heating Systems-Description; The Annual Energy Cost for Fuel Oil in Table 4-1 is Based on $0.73/gallon. That's what we pay when we purchase 2 million gallons per year. Expect a price increase (say 20%) if, after brac. we purchase 200,000 gallons per year.
RESPONSE: Fuel prices for distributed options will be increased by 20%.

15. **COMMENT:** Report 5.1 Mixed Utility Systems-General; Any scenario that considers retaining portions of existing central utilities has to factor in the costs associated with working in utilidors containing asbestos pipe installation.
RESPONSE: Cost of working in an asbestos environment for pipe insulation and distributed boiler connection will be added to the cost estimate.

16. **COMMENT:** Report 5.3 Mixed Utility Systems-General/Freeze Protection Options; The study concludes that the water system should remain centralized based on the economics presented in Table 5-1. The study then presents freeze protection methods and chooses combinations of circulation flow to drain, utilizing the existing system. The plan is the assumption of 100% reliability of the circulation. The only viable option to consider involves heating the water, insulating the pipes, then circulate to drain. Even with this option, flow must be maintained.
RESPONSE: The report will be modified to use the option recommended above which is the most reliable.

17. **COMMENT:** Report 5.2 Freeze Protection of Central Water Systems; Verify (identify the studies) that water flowing in a pipe will not form ice above a water temperature of 22-24°F I believe this is a standing matter case, not flowing water, and lasts only a short period of time.
RESPONSE: The source of this analysis will be referenced.

18. **COMMENT:** Report 6.2 LCCA Results; The option with the least life cycle cost will probably change. The option presented does not include costs of thawing lines and repairing pipes due to failure of circulation flow.
RESPONSE: See comment 16 above. It was agreed that the cost of thawing and repairing pipe should not be included for the new recommended option.

19. **COMMENT:** Report 6.2 LCCA Results-Table 6-1; The investment costs shown for "Distributed Steam Boilers" "Boiler Fuel Systems" and "Water Pipe Insulation" appear to be too low.
RESPONSE: We will modify cost estimate as per comments 11, 12, 13, and 15.

20. **COMMENT:** Report 7.2 Recommendations; The recommended option is not acceptable unless 100% reliability of circulation flow is assured.
RESPONSE: This recommendation will be changed. See comment 16.

VERBAL COMMENTS

1. A distributed boiler will also be required to heat Building 606, the power plant, where the water system is located.

2. The utility staff recommended should be raised form 2 to 4 people.

3. The burdened labor rate should be $35.00 per hour.

4. The statement regarding building deterioration should be removed. This deterioration process is currently not understood and is being studied.

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This meeting was adjourned.

DJ:nj
Action Required:
cc:

If any portion of this Confirmation Notice is incorrect, please notify us immediately. If correspondence is not received to the contrary within 14 days, it will be assumed that the decisions, conclusions, and status outlined in this Confirmation Notice are correct.

APPENDIX B

STEAM SYSTEM ANALYSIS

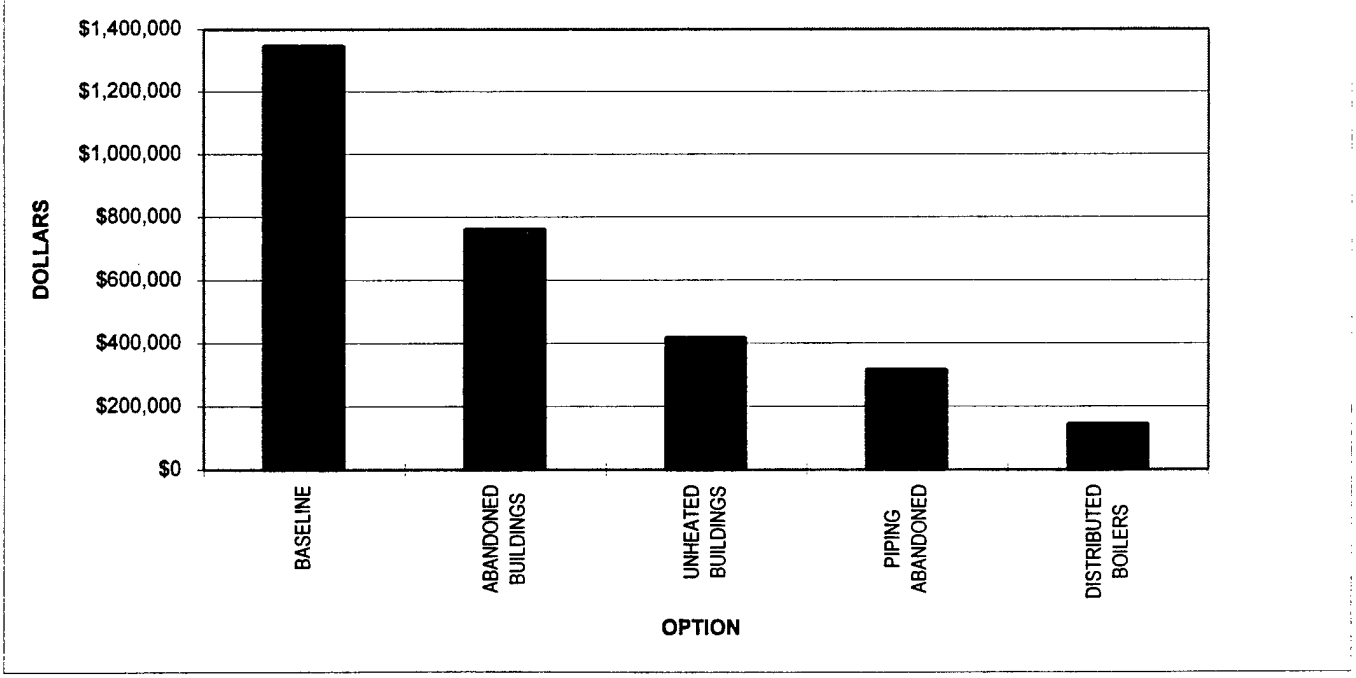
EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, Co 80227

STEAM SYSTEM SUMMARY

#1406.003
Ft. Greely Utility Study
3/15/96
JvS

	BASELINE	ABANDONED BUILDINGS	UNHEATED BUILDINGS	PIPING ABANDONED	DISTRIBUTED BOILERS
	Baseline central utilities: All buildings in use, heated to 70F	Central utilities: **abandoned** buildings heated to 45F	Central utilities: abandoned buildings **unheated**	Central utilities: abandoned buildings unheated and selected steam **piping abandoned**	**Distributed boilers:** abandoned buildings unheated
Area of active buildings (SF)	1,256,172 sf	257,376 sf	257,376 sf	257,376 sf	257,376 sf
Area of abandoned buildings (SF)	0 sf	998,796 sf	998,796 sf	998,796 sf	998,796 sf
Total Area (SF)	1,256,172 sf	1,256,172 sf	1,256,172 sf	1,256,172 sf	1,256,172 sf
Heat loss from active buildings (mbtu)	122,170 mbtu	23,407 mbtu	23,407 mbtu	23,407 mbtu	15,693 mbtu
Heat loss from abandoned buildings (mbtu)		45,432 mbtu			
Steam for Heating (mbtu)	122,170 mbtu	68,839 mbtu	23,407 mbtu	23,407 mbtu	15,693 mbtu
Steam for domestic water heating (mbtu)	26,486 mbtu	5,427 mbtu	5,427 mbtu	5,427 mbtu	3,638 mbtu
Steam for deaerator (mbtu)	19,085 mbtu	9,737 mbtu	5,194 mbtu	3,842 mbtu	0 mbtu
Steam pipe loss (mbtu)	23,109 mbtu	23,109 mbtu	23,109 mbtu	9,589 mbtu	0 mbtu
Total Steam Production (mbtu)	190,850 mbtu	107,112 mbtu	57,137 mbtu	42,265 mbtu	19,332 mbtu
Boiler fuel oil usage (gal)	1,791,484 gal	1,005,444 gal	536,336 gal	396,735 gal	181,466 gal
Boiler electrical usage (kwh)	466,502 kwh	344,794 kwh	332,179 kwh	332,179 kwh	159,362 kwh
Annual fuel oil cost	$1,307,783	$733,974	$391,525	$289,617	$132,470
Annual electrical cost	$39,576	$27,467	$26,462	$26,462	$12,695
Total annual energy cost	**$1,347,360**	**$761,441**	**$417,987**	**$316,079**	**$145,165**

TOTAL ENERGY COST



EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, Co 80227

BUILDING AREAS

BUILDING NUMBER	BUILDING DESCRIPTION	SQFT
501	POST HQ	19,095
503	GYMNASIUM	27,430
504	FIRE STATION	6,192
605	CONSOLIDATED PW	24,915
606	CENTRAL HEATING PLAN	31,333
612	TANK MAINTENANCE	18,681
615	ROADS AND GROUNDS	17,351
658	TEMP MOTOR POOL	25,425
725	SCHOOL	54,604
820	HOUSING UNIT	16,175
821	HOUSING UNIT	16,175
	TOTAL: REMAINING BUILDINGS	257,376 sf
	TOTAL: EXISTING AREA FROM 'Steam Pipe Study'	1,256,172 sf

EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, Co 80227

FUEL OIL COST
(BASELINE)

#1406.003
Ft. Greely Utility Study
3/15/96
JvS

Area of Ft. Greely **school**:	54,604 SF	Steam pressure:	55 psig
Area of Ft. Greely served by steam plant (**baseline**):	1,256,172 SF	Latent heat of evaporation:	907.8 btu/lb
Area of Ft. Greely **active** buildings served by steam plant:	257,376 SF	Fuel oil cost:	0.73 $/gal
Area of Ft. Greely **abandoned** buildings served by steam plant:	998,796 SF	Electrical rate charge:	0.0711 $/kwh
		Electrical demand charge:	6.25 $/kwh
		Manpower cost:	40 $/hr

STEAM FOR HEATING [FROM METERED FUEL OIL USAGE]

MONTH Aug '94 to Jul '95	OIL USAGE (corrected) (gal)	ELEC GEN USAGE (gal)	BOILER FUEL OIL USAGE (gal)	STEAM PRODUCTION (mbtu at 100psi)	STEAM FOR DOM. WATER (mtbu)	STEAM FOR DEAERATOR (mbtu)	STEAM PIPE LOSS (mbtu)	STEAM FOR HEATING (mbtu)	FUEL OIL COST ($)
Aug	83,045	-722	82,323	8,770	-2,207	-877	-1,926	3,760	60,096
Sep	119,527	-1,313	118,214	12,594	-2,207	-1,259	-1,926	7,201	86,296
Oct	157,732	-2,346	155,386	16,554	-2,207	-1,655	-1,926	10,765	113,432
Nov	214,447	-8,147	206,300	21,978	-2,207	-2,198	-1,926	15,647	150,599
Dec	239,799	-16,701	223,098	23,767	-2,207	-2,377	-1,926	17,257	162,862
Jan	230,947	-17,054	213,893	22,786	-2,207	-2,279	-1,926	16,375	156,142
Feb	208,500	-12,999	195,501	20,827	-2,207	-2,083	-1,926	14,611	142,716
Mar	216,410	-6,175	210,235	22,397	-2,207	-2,240	-1,926	16,024	153,472
Apr	123,238	-1,682	121,556	12,950	-2,207	-1,295	-1,926	7,522	88,736
May	107,588	-1,519	106,069	11,300	-2,207	-1,130	-1,926	6,037	77,430
Jun	84,352	-951	83,401	8,885	-2,207	-888	-1,926	3,863	60,883
Jul	76,730	-1,222	75,508	8,044	-2,207	-804	-1,926	3,107	55,121
TOTALS	1,862,315	-70,831	1,791,484	190,850	-26,486	-19,085	-23,109	122,170	$1,307,783

CALCULATE STEAM FOR HEATING

	OIL USAGE (corrected) (gal) (Data from Ft. Greely)
subtract (-)	ELEC GEN USAGE (gal) (Data from Ft. Greely)
equal (=)	BOILER FUEL OIL USAGE (gal)
multiply (x)	134,510 btu/gal (High Heat Value)
multiply (x)	.792 (boiler efficiency)
divide (/)	1,000,000 btu/mbtu
equal (=)	STEAM PRODUCTION (mbtu)
subtract (-)	STEAM FOR DOM. WATER (mbtu) (Calculated this sheet)
subtract (-)	STEAM FOR DEAERATOR (mbtu) (Calculated this sheet)
subtract (-)	STEAM PIPE LOSS (mbtu)
equal (=)	STEAM FOR HEATING (mbtu)

CALCULATE FUEL OIL COST

	BOILER FUEL OIL USAGE (gal)	
multiply (x)	0.73	FUEL OIL PRICE ($/gal)
equal (=)	FUEL OIL COST ($)	

CALCULATE STEAM PIPE LOSS

	-23,109	mbtu (pipe loss per year from 'Steam Dist. Study')
divide (/)	12	months per year
equal (=)	-1,926	mbtu (STEAM PIPE LOSS)

CALCULATE STEAM FOR DOMESTIC WATER PER MONTH

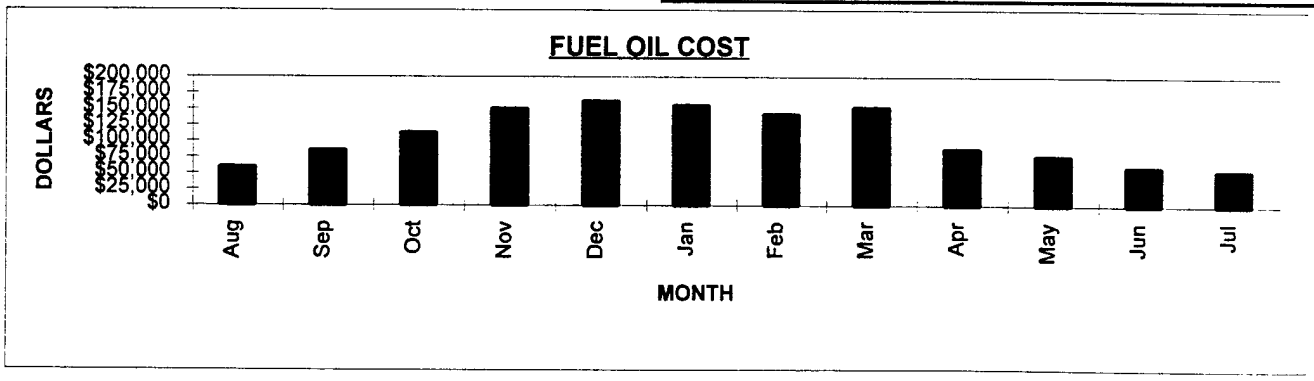
	8,044	mbtu (STEAM PRODUCTION in July)
subtract (-)	3,107	mbtu (STEAM FOR HEATING (calculated) in July)
subtract (-)	804	mbtu (STEAM FOR DEAERATOR in July)
subtract (-)	1,926	mbtu (STEAM PIPE LOSS in July)
equal (=)	2,207	mbtu (STEAM FOR DOM. WATER per month)

CALCULATE HEAT LOSS PER SQUARE FOOT

	4,966	mbtu (HEATING (SCHOOL) per year)
divide	54,604	SF (area of school)
equal (=)	0.091	mbtu/SF

CALCULATE STEAM FOR DEAERATOR

	STEAM PRODUCTION (mbtu)	
multiply (x)	10%	
equal (=)	STEAM FOR DEAERATOR (mbtu)	



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Denver, Co 80227

FUEL OIL COST
(ABANDONED BUILDINGS HEATED TO 45F)

#1406.003
Ft. Greely Utility Study
3/15/96
JvS

Area of Ft. Greely **school**: 54,604 SF
Area of Ft. Greely served by steam plant (**baseline**): 1,256,172 SF
Area of Ft. Greely **active** buildings served by steam plant: 257,376 SF
Area of Ft. Greely **abandoned** buildings served by steam plant: 998,796 SF

STEAM PRODUCTION [CALCULATED]

MONTH Aug '94 to Jul '95	HEATING (SCHOOL45F) (mbtu)	HEATING (ABANDONED) (mbtu)	HEATING (ACTIVE) (mbtu)	STEAM FOR DOM. WATER (mtbu)	STEAM FOR DEAERATOR (mbtu)	STEAM PIPE LOSS (mbtu)	STEAM PRODUCTION (mbtu)	BOILER FUEL OIL USAGE (gal)	FUEL OIL COST ($)
Aug	3.40	62	669	452	311	1,926	3,420	32,101	23,433
Sep	30.31	554	1,018	452	395	1,926	4,345	40,786	29,774
Oct	157.46	2,880	1,855	452	711	1,926	7,824	73,444	53,614
Nov	319.66	5,847	2,659	452	1,088	1,926	11,973	112,387	82,042
Dec	470.00	8,597	3,419	452	1,439	1,926	15,834	148,629	108,499
Jan	501.70	9,177	3,638	452	1,519	1,926	16,712	156,870	114,515
Feb	398.05	7,281	2,982	452	1,264	1,926	13,905	130,523	95,282
Mar	340.07	6,220	2,726	452	1,132	1,926	12,456	116,926	85,356
Apr	191.74	3,507	1,910	452	779	1,926	8,574	80,487	58,755
May	57.70	1,056	1,139	452	457	1,926	5,030	47,214	34,466
Jun	11.23	205	757	452	334	1,926	3,674	34,492	25,179
Jul	2.44	45	637	452	306	1,926	3,365	31,587	23,059
TOTALS	2,483.75	45,432	23,407	5,427	9,737	23,109	107,112	1,005,444	$733,974

CALCULATE BOILER FUEL OIL USAGE

HEATING (SCHOOL 45F) (mbtu) (Calculated)
divide (/) Area of school (SF)
multiply (x) Area of abandoned (SF)
equal (=) HEATING (ABANDONED) (mbtu)
add (+) HEATING (MODIFIED) (mbtu)
add (+) STEAM FOR DOM. WATER (mbtu)
add (+) STEAM FOR DEAERATOR (mbtu)
add (+) STEAM PIPE LOSS (mbtu)
equal (=) STEAM PRODUCTION (mbtu)
multiply (x) 1,000,000 btu/mbtu
divide (/) 134,510 btu/gal (High Heat Value)
divide (/) .792 (boiler efficiency)
equal (=) BOILER FUEL OIL USAGE (gal)

CALCULATE FUEL OIL COST

BOILER FUEL OIL USAGE (gal)
multiply (x) 0.73 FUEL OIL PRICE ($/gal)
equal (=) FUEL OIL COST ($)

CALCULATE STEAM FOR DOMESTIC WATER

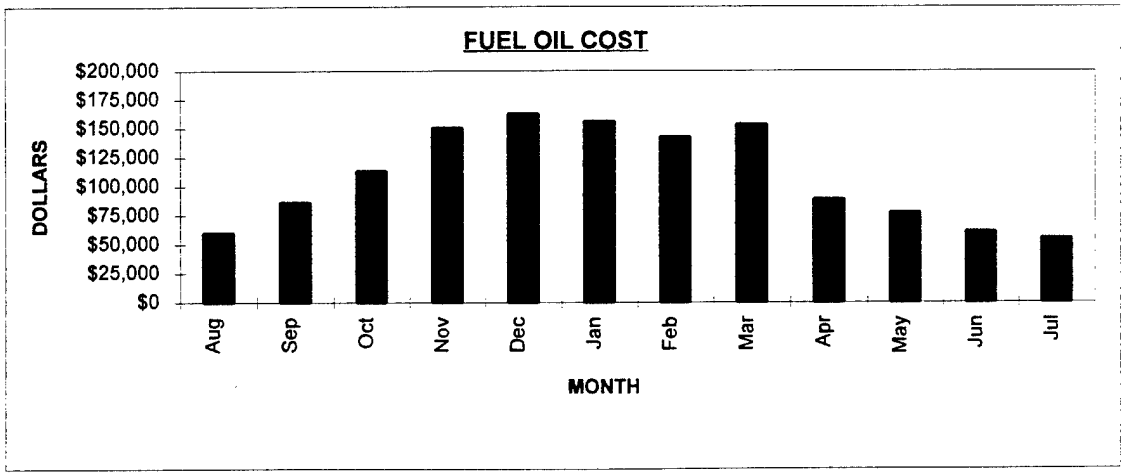
STEAM FOR DOM. WATER [complex] (mbtu)
divide (/) Area of school (SF)
multiply (x) Area of modified (SF)
equal (=) STEAM FOR DOM. WATER [modified] (mbtu)

CALCULATE STEAM PIPE LOSS

-23,109 mbtu (pipe loss per year from 'Steam Dist. Study')
divide (/) 12 months per year
equal (=) -1,926 mbtu (STEAM PIPE LOSS)

CALCULATE STEAM FOR DEAERATTOR

HEATING (ABANDONED) (mbtu)
add (+) HEATING (MODIFIED) (mbtu)
add (+) STEAM FOR DOM. WATER (mbtu)
add (+) STEAM PIPE LOSS (mbtu)
equal (=) Steam usage (mbtu)
multiply (x) 10%, Industry standard
equal (=) STEAM FOR DEAERATOR (mbtu)



EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, Co 80227

FUEL OIL COST
(ABANDONED BUILDINGS UNHEATED)

#1406.003
Ft. Greely Utility Study
3/15/96
JvS

Area of Ft. Greely **school**: 54,604 SF
Area of Ft. Greely served by steam plant (**baseline**): 1,256,172 SF
Area of Ft. Greely **active** buildings served by steam plant: 257,376 SF
Area of Ft. Greely **abandoned** buildings served by steam plant: 998,796 SF

STEAM PRODUCTION [CALCULATED]

MONTH Aug '94 to Jul '95	HEATING (SCHOOL) (mbtu)	HEATING (ACTIVE) (mbtu)	STEAM FOR DOM. WATER (mtbu)	STEAM FOR DEAERATOR (mbtu)	STEAM PIPE LOSS (mbtu)	STEAM PRODUCTION (mbtu)	BOILER FUEL OIL USAGE (gal)	FUEL OIL COST ($)
Aug	141.88	669	452	305	1,926	3,351	31,459	22,965
Sep	215.90	1,018	452	340	1,926	3,735	35,061	25,595
Oct	393.50	1,855	452	423	1,926	4,656	43,705	31,905
Nov	564.18	2,659	452	504	1,926	5,541	52,012	37,969
Dec	725.41	3,419	452	580	1,926	6,377	59,859	43,697
Jan	771.73	3,638	452	602	1,926	6,617	62,114	45,343
Feb	632.60	2,982	452	536	1,926	5,896	55,342	40,400
Mar	578.26	2,726	452	510	1,926	5,614	52,698	38,469
Apr	405.14	1,910	452	429	1,926	4,716	44,272	32,318
May	241.65	1,139	452	352	1,926	3,869	36,315	26,510
Jun	160.63	757	452	314	1,926	3,449	32,372	23,631
Jul	135.04	637	452	301	1,926	3,316	31,126	22,722
TOTALS	4,966	23,407	5,427	5,194	23,109	57,137	536,336	$391,525

STEAM FOR HEATING (COMPLEX) [CALCULATED]

HEATING (SCHOOL) (mbtu)	HEATING (COMPLEX) (mbtu)
141.88	3,264
215.90	4,967
393.50	9,052
564.18	12,979
725.41	16,688
771.73	17,754
632.60	14,553
578.26	13,303
405.14	9,320
241.65	5,559
160.63	3,695
135.04	3,107
4,966	114,242

CALCULATE BOILER FUEL OIL USAGE

HEATING (SCHOOL) (mbtu) [Calculated]
divide (/) Area of school (SF)
multiply (x) Area of modified (SF)
equal (=) HEATING (MODIFIED) (mbtu)
add (+) STEAM FOR DOM. WATER (mbtu)
add (+) STEAM FOR DEAERATOR (mbtu)
add (+) STEAM PIPE LOSS (mbtu)
equal (=) STEAM PRODUCTION (mbtu)
multiply (x) 1,000,000 btu/mbtu
divide (/) 134,510 btu/gal (High Heat Value)
divide (/) .792 (boiler efficiency)
equal (=) BOILER FUEL OIL USAGE (gal)

CALCULATE FUEL OIL COST

BOILER FUEL OIL USAGE (gal)
multiply (x) 0.73 FUEL OIL PRICE ($/gal)
equal (=) FUEL OIL COST ($)

CALCULATE STEAM PIPE LOSS

-23,109 mbtu (pipe loss per year)
divide (/) 12 months per year
equal (=) -1,926 mbtu (STEAM PIPE LOSS)

CALCULATE STEAM FOR DOMESTIC WATER

STEAM FOR DOM. WATER (complex) (mbtu)
divide (/) Area of complex (SF)
multiply (x) Area of modified (SF)
equal (=) STEAM FOR DOM. WATER (modified) (mbtu)

CALCULATE STEAM FOR HEATING (COMPLEX)

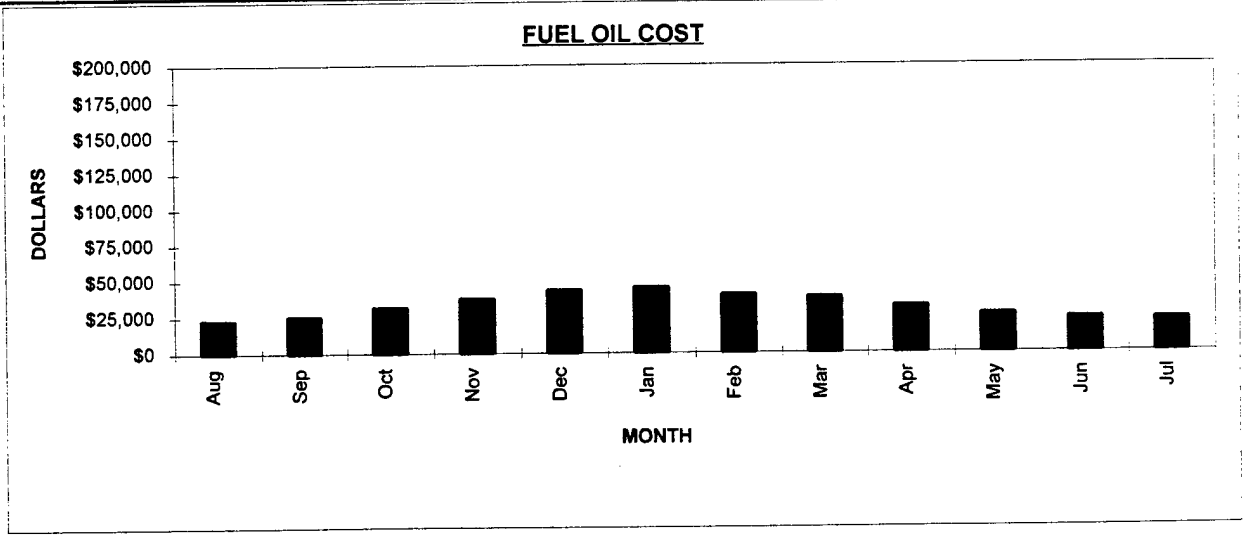
HEATING (SCHOOL) (mbtu) (Calculated)
divide (/) Area of school (SF)
multiply (x) Area of complex (SF)
equal (=) HEATING (COMPLEX) (mbtu)

CALCULATE MEASURED TO CALCULATED RATIO

122,170 STEAM FOR HEATING (complex) (mbtu) [Measured]
divide (/) 114,242 HEATING (COMPLEX) (mbtu) [Calculated]
equal (=) 1.07 Ratio of calculated steam for heating to measured

CALCULATE STEAM USED FOR DEAERATOR

HEATING (MODIFIED) (mbtu)
add (+) STEAM FOR DOM. WATER (mbtu)
add (+) STEAM PIPE LOSS (mbtu)
equal (=) Steam usage (mbtu)
multiply (x) 10%, Industry standard
equal (=) STEAM FOR DEAERATOR (mbtu)



EMC Engineers, Inc
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Denver, Co 80227

FUEL OIL COST
(ABANDONED BUILDINGS UNHEATED,
SELECTED STEAM PIPING ABANDONED)

#1406.003
Ft. Greely Utility Study
3/15/96
JvS

Area of Ft. Greely **school**:	54,604 SF
Area of Ft. Greely served by steam plant (**baseline**):	1,256,172 SF
Area of Ft. Greely **active** buildings served by steam plant:	257,376 SF
Area of Ft. Greely **abandoned** buildings served by steam plant:	998,796 SF

STEAM PRODUCTION [CALCULATED]

MONTH Aug '94 to Jul '95	HEATING (SCHOOL) (mbtu)	HEATING (ACTIVE) (mbtu)	STEAM FOR DOM. WATER (mtbu)	STEAM FOR DEAERATOR (mbtu)	STEAM PIPE LOSS (mbtu)	STEAM PRODUCTION (mbtu)	BOILER FUEL OIL USAGE (gal)	FUEL OIL COST ($)
August	141.88	669	452	192	799	2,112	19,826	14,473
September	215.90	1,018	452	227	799	2,496	23,428	17,103
October	393.50	1,855	452	311	799	3,417	32,072	23,412
November	564.18	2,659	452	391	799	4,302	40,379	29,477
December	725.41	3,419	452	467	799	5,138	48,226	35,205
January	771.73	3,638	452	489	799	5,378	50,480	36,851
February	632.60	2,982	452	423	799	4,656	43,709	31,908
March	578.26	2,726	452	398	799	4,375	41,064	29,977
April	405.14	1,910	452	316	799	3,477	32,638	23,826
May	241.65	1,139	452	239	799	2,629	24,682	18,018
June	160.63	757	452	201	799	2,209	20,738	15,139
July	135.04	637	452	189	799	2,077	19,493	14,230
TOTALS	4,966	23,407	5,427	3,842	9,589	42,265	396,735	$289,617

CALCULATE BOILER FUEL OIL USAGE

	HEATING (SCHOOL) (mbtu) [Calculated]
divide (/)	Area of school (SF)
multiply (x)	Area of modified (SF)
equal (=)	HEATING (MODIFIED) (mbtu)
add (+)	STEAM FOR DOM. WATER (mbtu)
add (+)	STEAM FOR DEAERATOR (mbtu)
add (+)	STEAM PIPE LOSS (mbtu)
equal (=)	STEAM PRODUCTION (mbtu)
multiply (x)	1,000,000 btu/mbtu
divide (/)	134,510 btu/gal (High Heat Value)
divide (/)	.792 (boiler efficiency)
equal (=)	BOILER FUEL OIL USAGE (gal)

CALCULATE FUEL OIL COST

	BOILER FUEL OIL USAGE (gal)
multiply (x)	0.73 FUEL OIL PRICE ($/gal)
equal (=)	FUEL OIL COST ($)

CALCULATE STEAM FOR DOMESTIC WATER

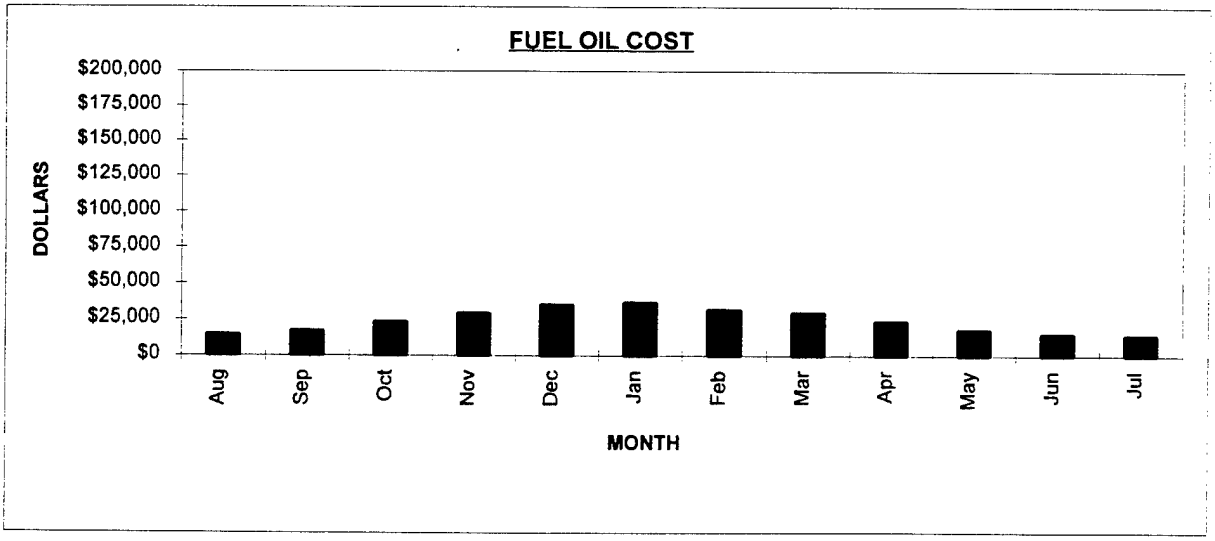
	STEAM FOR DOM. WATER [COMPLEX] (mbtu)
divide (/)	AREA OF COMPLEX (SF)
multiply (x)	AREA OF MODIFIED (SF)
equal (=)	STEAM FOR DOM. WATER [MODIFIED] (mbtu)

CALCULATE PIPE HEAT LOSS (PIPING CUT)

	-9,589 mbtu (pipe loss per year) [Calculated]
divide	12 months per year
=	-799 mbtu (STEAM PIPE LOSS)

CALCULATE STEAM USED FOR DEAERATOR

	HEATING (MODIFIED) (mbtu)
add (+)	STEAM FOR DOM. WATER (mbtu)
add (+)	STEAM PIPE LOSS (mbtu)
equal (=)	Steam usage (mbtu)
multiply (x)	10%, Industry standard
equal (=)	STEAM FOR DEAERATOR (mbtu)



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PEAK BOILER DEMAND (BASELINE)

#1406.003
Ft. Greely Utility Study
3/15/96
JvS

PEAK STEAM PRODUCTION

MONTH Aug '94 to Jul '95	PEAK HEATING (SCHOOL) (mbtuh)	PEAK HEATING (COMPLEX) (mbtuh)	PEAK STEAM FOR DOM. WATER (mbtuh)	PEAK STEAM FOR DEAERATOR (mbtu)	PEAK STEAM PIPE LOSS (mbtuh)	PEAK STEAM PRODUCTION (mbtuh)	PEAK STEAM PRODUCTION (lbs/hr)	# BOILERS FIRING (peak)
Aug	0.40	9.18	9.20	1.84	2.67	22.9	25,213	1
Sep	0.56	12.81	9.20	2.20	2.67	26.9	29,617	1
Oct	0.78	17.97	9.20	2.72	2.67	32.6	35,861	2
Nov	1.08	24.78	9.20	3.40	2.67	40.0	44,112	2
Dec	1.51	34.83	9.20	4.40	2.67	51.1	56,294	2
Jan	1.76	40.42	9.20	4.96	2.67	57.3	63,068	2
Feb	1.43	32.78	9.20	4.20	2.67	48.9	53,813	2
Mar	1.29	29.75	9.20	3.89	2.67	45.5	50,134	2
Apr	1.01	23.24	9.20	3.24	2.67	38.3	42,245	2
May	0.68	15.57	9.20	2.48	2.67	29.9	32,962	2
Jun	0.47	10.81	9.20	2.00	2.67	24.7	27,192	1
Jul	0.42	9.57	9.20	1.88	2.67	23.3	25,686	1

CALCULATE PEAK STEAM PRODUCTION

	PEAK HEATING (SCHOOL) (mbtuh) [Calculated]
divide (/)	Area of school (SF)
multiply (x)	Area of complex (SF)
equal (=)	PEAK HEATING (COMPLEX) (mbtuh)
add (+)	PEAK STEAM FOR DOM. WATER (mbtuh)
add (+)	PEAK STEAM FOR DEAERATOR (mbtuh)
add (+)	PEAK STEAM PIPE LOSS (mbtuh)
equal (=)	PEAK STEAM PRODUCTION (mbtuh)
multiply (x)	1,000,000 btu/mbtu
divide (/)	907.8 btu/lb (Latent heat of evaporation)
equal (=)	PEAK STEAM PRODUCTION (lbs/hr)

CALCULATE NUMBER OF BOILERS FIRING

IF up to 30,000 lbs/hr: Boiler-1 on, Boiler-2 off, Boiler-3 off
IF 30,001 lbs/hr to 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 off
IF greater than 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 on

CALCULATE STEAM PIPE LOSS

	-23,109 mbtu (pipe loss per year from 'Steam Dist. Study')
divide (/)	12 months per year
equal (=)	-1,926 mbtu (STEAM PIPE LOSS)
divide (/)	(30*24) (30 days per month, 24 hours per day)
equal (=)	-2.67 mbtuh (STEAM PIPE LOSS)

CALCULATE BOILER-FEED WATER PUMP SIZE

	63,068 lbs/hr (PEAK STEAM PRODUCTION)
multiply (x)	0.01782 cf/lb (Specific volume water at 330F)
multiply (x)	55.96 gal/cf (Density of water at 330F)
equal (=)	62,892 gal/hr (Peak water usage)
multiply (x)	10% (Percent boiler-feed water)
equal (=)	6,289 gal/hr (Boiler-feed water)
divide (/)	60 min/hr
equal (=)	105 gpm (Boiler-feed water)

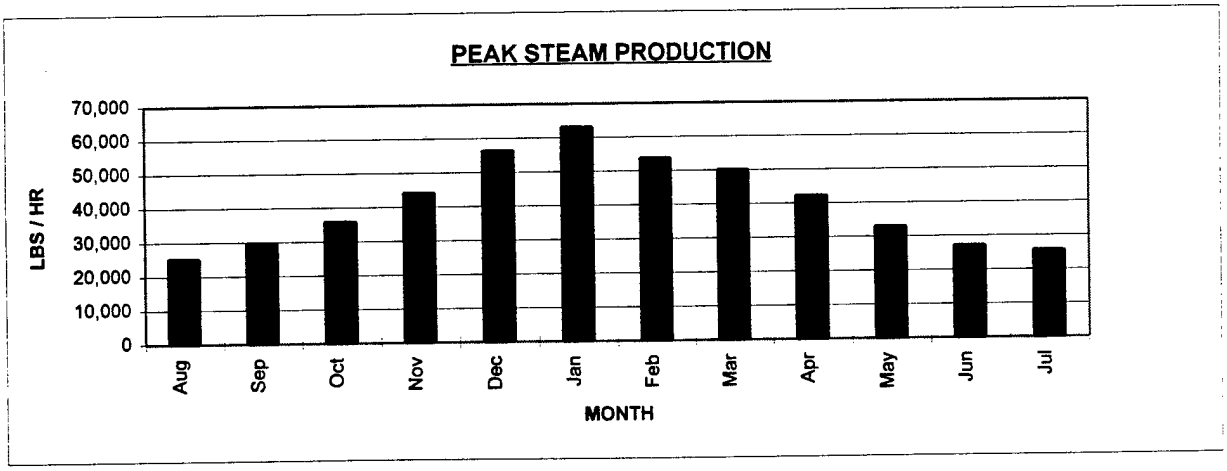
105gpm at 125psi, boiler feed water
2 pumps (60gpm, 350 feet), 15 hp

CALCULATE STEAM FOR DOMESTIC WATER

	8,044 mbtu (STEAM PRODUCTION in July)
subtract (-)	3,107 mbtu (STEAM FOR HEATING in July)
subtract (-)	804 mbtu (STEAM FOR DEAERATOR in July)
subtract (-)	1,926 mbtu (STEAM PIPE LOSS in July)
equal (=)	2,207 mbtu (STEAM FOR DOM. WATER per month)
divide (/)	(30*8) 30days per month, 8 hours use per day
equal (=)	9.20 PEAK STEAM FOR DOM. WATER (mbtuh)

CALCULATE STEAM FOR DEAERATOR

	PEAK HEATING (COMPLEX) (mbtuh)
add (+)	PEAK STEAM FOR DOM. WATER (mbtuh)
add (+)	PEAK STEAM PIPE LOSS (mbtuh)
equal (=)	Peak steam usage (mbtuh)
multiply (x)	10%, Industry standard
equal (=)	PEAK STEAM FOR DEAERATOR (mbtuh)



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Denver, Co 80227

PEAK BOILER DEMAND
(ABANDONED BUILDINGS HEATED TO 45F)

PEAK STEAM PRODUCTION									
MONTH Aug '94 to Jul '95	PEAK HEATING (SCHOOL 45F) (mbtuh)	PEAK HEATING (ABANDONED) (mbtuh)	PEAK HEATING (ACTIVE) (mbtuh)	PEAK STEAM FOR DOM. WATER (mbtuh)	PEAK STEAM FOR DEAERATOR (mbtu)	PEAK STEAM PIPE LOSS (mbtuh)	PEAK STEAM PRODUCTION (mbtuh)	PEAK STEAM PRODUCTION (lbs/hr)	# BOILERS FIRING (peak)
August	0.091	2.09	1.88	1.88	0.85	2.67	9.4	10,340	1
September	0.233	5.36	2.63	1.88	1.25	2.67	13.8	15,201	1
October	0.459	10.56	3.68	1.88	1.88	2.67	20.7	22,780	1
November	0.679	15.62	5.08	1.88	2.53	2.67	27.8	30,603	2
December	1.050	24.16	7.14	1.88	3.59	2.67	39.4	43,441	2
January	1.021	23.49	8.28	1.88	3.63	2.67	40.0	44,020	2
February	0.987	22.71	6.72	1.88	3.40	2.67	37.4	41,176	2
March	0.947	21.79	6.09	1.88	3.24	2.67	35.7	39,307	2
April	0.668	15.37	4.76	1.88	2.47	2.67	27.2	29,914	1
May	0.278	6.40	3.19	1.88	1.41	2.67	15.6	17,140	1
June	0.137	3.15	2.22	1.88	0.99	2.67	10.9	12,028	1
July	0.093	2.14	1.96	1.88	0.87	2.67	9.5	10,493	1

CALCULATE PEAK STEAM PRODUCTION

	PEAK HEATING (SCHOOL 45F) (mbtuh) [Calculated]
divide (/)	Area of school (SF)
multiply (x)	Area of abandoned (SF)
equal (=)	PEAK HEATING (ABANDONED) (mbtuh)
add (+)	PEAK HEATING (MODIFIED) (mbtuh)
add (+)	PEAK STEAM FOR DOM. WATER (mbtuh)
add (+)	PEAK STEAM FOR DEAERATOR (mbtuh)
add (+)	PEAK STEAM PIPE LOSS (mbtuh)
equal (=)	PEAK STEAM PRODUCTION (mbtuh)
multiply (x)	1,000,000 btu/mbtu
divide (/)	907.8 btu/lb (Latent heat of evaporation)
equal (=)	PEAK STEAM PRODUCTION (lbs/hr)

CALCULATE NUMBER OF BOILERS FIRING

IF up to 30,000 lbs/hr: Boiler-1 on, Boiler-2 off, Boiler-3 off
IF 30,001 lbs/hr to 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 off
IF greater than 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 on

CALCULATE STEAM PIPE LOSS

	-23,109 mbtu (pipe loss per year from 'Steam Dist. Study')
divide (/)	12 months per year
equal (=)	-1,926 mbtu (STEAM PIPE LOSS)
divide (/)	(30*24) (30 days per month, 24 hours per day)
equal (=)	-2.67 mbtuh (STEAM PIPE LOSS)

CALCULATE BOILER-FEED WATER PUMP SIZE

	44,020 lbs/hr (PEAK STEAM PRODUCTION)
multiply (x)	0.01782 cf/lb (Specific volume water at 330F)
multiply (x)	55.96 gal/cf (Density of water at 330F)
equal (=)	43,897 gal/hr (Peak water usage)
multiply (x)	10% (Percent boiler-feed water)
equal (=)	4,390 gal/hr (Boiler-feed water)
divide (/)	60 min/hr
equal (=)	73 gpm (Boiler-feed water)

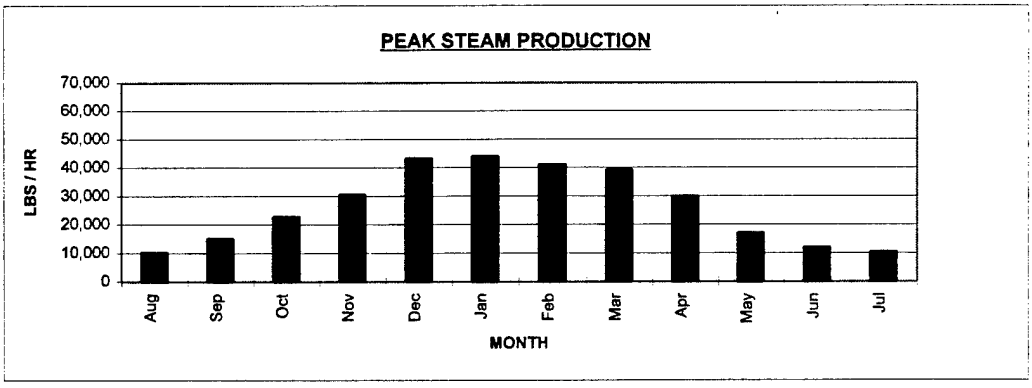
73gpm at 125psi, boiler feed water
2 pumps (46gpm, 350 feet), 10 hp

CALCULATE STEAM FOR DOMESTIC WATER

	PEAK STEAM FOR DOM. WATER [Complex] (mbtuh)
divide (/)	Area of complex (SF)
multiply (x)	Area of modified (SF)
equal (=)	PEAK STEAM FOR DOM. WATER [Modified] (mbtuh)

CALCULATE STEAM FOR DEAERATOR

	PEAK HEATING (ABANDONED) (mbtuh)
add (+)	PEAK HEATING (MODIFIED) (mbtuh)
add (+)	PEAK STEAM FOR DOM. WATER (mbtuh)
add (+)	PEAK STEAM PIPE LOSS (mbtuh)
equal (=)	Peak steam usage (mbtuh)
multiply (x)	10%, Industry standard
equal (=)	PEAK STEAM FOR DEAERATOR (mbtuh)



EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, Co 80227

PEAK BOILER DEMAND
(ABANDONED BUILDINGS UNHEATED)

#1406.003
Ft. Greely Utility Study
3/15/96
JvS

PEAK STEAM PRODUCTION								
MONTH Aug '94 to Jul '95	PEAK HEATING (SCHOOL) (mbtuh)	PEAK HEATING (ACTIVE) (mbtuh)	PEAK STEAM FOR DOM. WATER (mbtuh)	PEAK STEAM FOR DEAERATOR (mbtu)	PEAK STEAM PIPE LOSS (mbtuh)	PEAK STEAM PRODUCTION (mbtuh)	PEAK STEAM PRODUCTION (lbs/hr)	# BOILERS FIRING (peak)
August	0.399	1.88	1.88	0.64	2.67	7.1	7,803	1
September	0.557	2.63	1.88	0.72	2.67	7.9	8,705	1
October	0.781	3.68	1.88	0.82	2.67	9.1	9,985	1
November	1.077	5.08	1.88	0.96	2.67	10.6	11,675	1
December	1.514	7.14	1.88	1.17	2.67	12.9	14,171	1
January	1.757	8.28	1.88	1.28	2.67	14.1	15,559	1
February	1.425	6.72	1.88	1.13	2.67	12.4	13,663	1
March	1.293	6.09	1.88	1.07	2.67	11.7	12,909	1
April	1.010	4.76	1.88	0.93	2.67	10.3	11,293	1
May	0.677	3.19	1.88	0.77	2.67	8.5	9,391	1
June	0.470	2.22	1.88	0.68	2.67	7.5	8,209	1
July	0.416	1.96	1.88	0.65	2.67	7.2	7,900	1

CALCULATE PEAK STEAM PRODUCTION

	PEAK HEATING (SCHOOL) (mbtuh) [Calculated]
divide (/)	Area of school (SF)
multiply (x)	Area of modified (SF)
equal (=)	PEAK HEATING (MODIFIED) (mbtuh)
add (+)	PEAK STEAM FOR DOM. WATER (mbtuh)
add (+)	PEAK STEAM FOR DEAERATOR (mbtuh)
add (+)	PEAK STEAM PIPE LOSS (mbtuh)
equal (=)	PEAK STEAM PRODUCTION (mbtuh)
multiply (x)	1,000,000 btu/mbtu
divide (/)	907.8 btu/lb (Latent heat of evaporation)
equal (=)	PEAK STEAM PRODUCTION (lbs/hr)

CALCULATE BOILER-FEED WATER PUMP SIZE

	15,559 lbs/hr (Peak steam produced)
multiply (x)	0.01782 cf/lb (specific volume water at 330F)
multiply (x)	55.96 gal/cf (density of water at 330F)
equal (=)	15,516 gal/hr (water)
multiply (x)	10% (percent boiler-feed water)
equal (=)	1,552 gal/hr (boiler-feed water)
divide (/)	60 min/hr
equal (=)	26 gpm (boiler-feed water)

26gpm at 125psi, boiler feed water
1 pump (17gpm, 350 feet), 7 1/2 hp

CALCULATE NUMBER OF BOILERS FIRING

IF up to 30,000 lbs/hr: Boiler-1 on, Boiler-2 off, Boiler-3 off
IF 30,001 lbs/hr to 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 off
IF greater than 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 on

CALCULATE STEAM PIPE LOSS

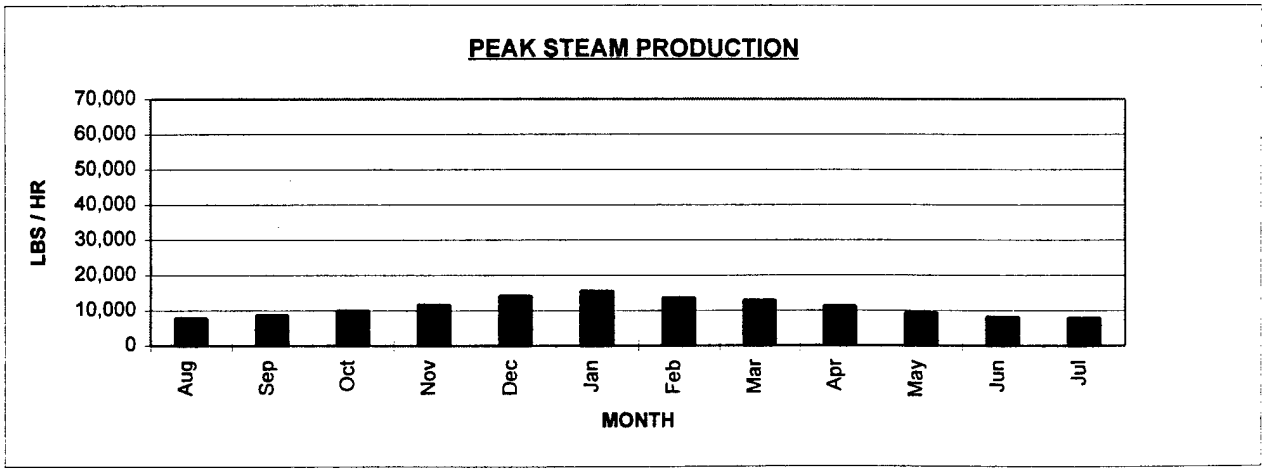
	-23,109 mbtu (pipe loss per year from 'Steam Dist. Study')
divide (/)	12 months per year
equal (=)	-1,926 mbtu (STEAM PIPE LOSS)
divide (/)	(30*24) (30 days per month, 24 hours per day)
equal (=)	-2.67 mbtuh (STEAM PIPE LOSS)

CALCULATE STEAM FOR DOMESTIC WATER

	PEAK STEAM FOR DOM. WATER [Complex] (mbtuh)
divide (/)	Area of complex (SF)
multiply (x)	Area of modified (SF)
equal (=)	PEAK STEAM FOR DOM. WATER [Modified] (mbtuh)

CALCULATE STEAM FOR DEAERATOR

	PEAK HEATING (MODIFIED) (mbtuh)
add (+)	PEAK STEAM FOR DOM. WATER (mbtuh)
add (+)	PEAK STEAM PIPE LOSS (mbtuh)
equal (=)	Peak steam usage (mbtuh)
multiply (x)	10%, Industry standard
equal (=)	PEAK STEAM FOR DEAERATOR (mbtuh)



EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, Co 80227

PEAK BOILER DEMAND
(ABANDONED BUILDINGS UNHEATED)
(SELECTED STEAM PIPING ABANDONED)

#1406.003
Ft. Greely Utility Study
3/15/96
JvS

PEAK STEAM PRODUCTION								
MONTH Aug '94 to Jul '95	PEAK HEATING (SCHOOL) (mbtuh)	PEAK HEATING (MODIFIED) (mbtuh)	PEAK STEAM FOR DOM. WATER (mbtuh)	PEAK STEAM FOR DEAERATOR (mbtu)	PEAK STEAM PIPE LOSS (mbtuh)	PEAK STEAM PRODUCTION (mbtuh)	PEAK STEAM PRODUCTION (lbs/hr)	# BOILERS FIRING (peak)
August	0.399	1.88	1.88	0.49	1.11	5.4	5,907	1
September	0.557	2.63	1.88	0.56	1.11	6.2	6,809	1
October	0.781	3.68	1.88	0.67	1.11	7.3	8,089	1
November	1.077	5.08	1.88	0.81	1.11	8.9	9,779	1
December	1.514	7.14	1.88	1.01	1.11	11.1	12,275	1
January	1.757	8.28	1.88	1.13	1.11	12.4	13,663	1
February	1.425	6.72	1.88	0.97	1.11	10.7	11,767	1
March	1.293	6.09	1.88	0.91	1.11	10.0	11,013	1
April	1.010	4.76	1.88	0.78	1.11	8.5	9,397	1
May	0.677	3.19	1.88	0.62	1.11	6.8	7,495	1
June	0.470	2.22	1.88	0.52	1.11	5.7	6,312	1
July	0.416	1.96	1.88	0.50	1.11	5.5	6,004	1

CALCULATE PEAK STEAM PRODUCTION

	PEAK HEATING (SCHOOL) (mbtuh) [Calculated]
divide (/)	Area of school (SF)
multiply (x)	Area of modified (SF)
equal (=)	PEAK HEATING (MODIFIED) (mbtuh)
add (+)	PEAK STEAM FOR DOM. WATER (mbtuh)
add (+)	PEAK STEAM FOR DEAERATOR (mbtuh)
add (+)	PEAK STEAM PIPE LOSS (mbtuh)
equal (=)	PEAK STEAM PRODUCTION (mbtuh)
multiply (x)	1,000,000 btu/mbtu
divide (/)	907.8 btu/lb (Latent heat of evaporation)
equal (=)	PEAK STEAM PRODUCTION (lbs/hr)

CALCULATE NUMBER OF BOILERS FIRING

IF up to 30,000 lbs/hr: Boiler-1 on, Boiler-2 off, Boiler-3 off
IF 30,001 lbs/hr to 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 off
IF greater than 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 on

CALCULATE PIPE HEAT LOSS

	-9,589 mbtu (pipe loss per year) [Calculated]
divide (/)	12 months per year
equal (=)	-799 mbtu (STEAM PIPE LOSS)
divide (/)	(30*24) (30 days per month, 24 hours per day)
equal (=)	-1.11 mbtuh (STEAM PIPE LOSS)

CALCULATE BOILER-FEED WATER PUMP SIZE

	13,663 lbs/hr (Peak steam produced)
multiply (x)	0.01782 cf/lb (specific volume water at 330F)
multiply (x)	55.96 gal/cf (density of water at 330F)
equal (=)	13,625 gal/hr (water)
multiply (x)	10% (percent boiler-feed water)
equal (=)	1,362 gal/hr (boiler-feed water)
divide (/)	60 min/hr
equal (=)	23 gpm (boiler-feed water)

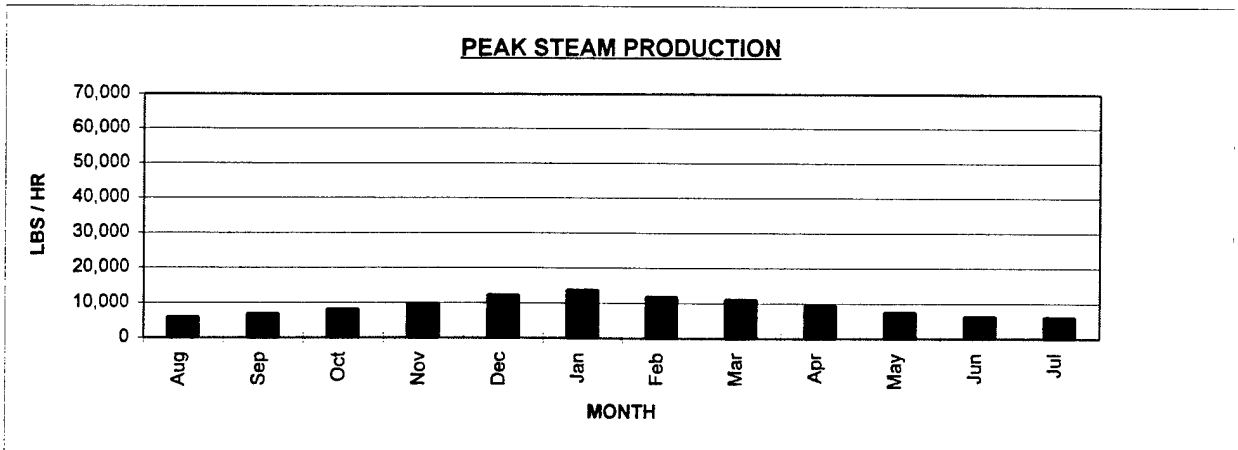
23gpm at 125psi, boiler feed water
1 pump (26 gpm, 350 feet), 7 1/2 hp

CALCULATE STEAM FOR DOMESTIC WATER

	PEAK STEAM FOR DOM. WATER [Complex] (mbtuh)
divide (/)	Area of complex (SF)
multiply (x)	Area of modified (SF)
equal (=)	PEAK STEAM FOR DOM. WATER [Modified] (mbtuh)

CALCULATE STEAM USED FOR DEAERATOR

	PEAK HEATING (ABANDONED) (mbtuh)
add (+)	PEAK HEATING (MODIFIED) (mbtuh)
add (+)	PEAK STEAM FOR DOM. WATER (mbtuh)
add (+)	PEAK STEAM PIPE LOSS (mbtuh)
equal (=)	Peak steam usage (mbtuh)
multiply (x)	10%, Industry standard
equal (=)	PEAK STEAM FOR DEAERATOR (mbtuh)



EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, Co 80227

ANNUAL CENTRAL PLANT ELECTRICITY USAGE
(BASELINE)

BOILER FIRING TIME

MONTH Aug '94 to Jul '95	AVERAGE HEATING (SCHOOL) (mbtuh)	AVERAGE HEATING (COMPLEX) (mbtuh)	AVE STEAM FOR DOM. WATER (mbtuh)	AVE STEAM FOR DEAERATOR (mbtuh)	AVERAGE STEAM PIPE LOSS (mbtuh)	AVERAGE STEAM PRODUCTION (lbs/hr)	AVERAGE STEAM PRODUCTION (lbs/hr)	# BOILERS FIRING (average)	# DAYS	BOILER FIRING TIME (hours)
August	0.191	4.39	3.07	1.01	2.67	11.1	12,280	1	31	744
September	0.300	6.90	3.07	1.26	2.67	13.9	15,318	1	30	720
October	0.529	12.17	3.07	1.79	2.67	19.7	21,702	1	31	744
November	0.784	18.04	3.07	2.38	2.67	26.2	28,810	1	30	720
December	0.975	22.43	3.07	2.82	2.67	31.0	34,134	2	31	1,488
January	1.037	23.86	3.07	2.96	2.67	32.6	35,863	2	31	1,488
February	0.942	21.67	3.07	2.74	2.67	30.2	33,215	2	28	1,344
March	0.777	17.87	3.07	2.36	2.67	26.0	28,615	1	31	744
April	0.563	12.95	3.07	1.87	2.67	20.6	22,650	1	30	720
May	0.324	7.45	3.07	1.32	2.67	14.5	15,987	1	31	744
June	0.223	5.13	3.07	1.09	2.67	12.0	13,172	1	30	720
July	0.181	4.16	3.07	0.99	2.67	10.9	12,001	1	31	744
TOTAL										10,920

CALCULATE AVERAGE STEAM PRODUCTION

	AVERAGE HEATING (SCHOOL) (mbtuh) [Calculated]
divide (/)	Area of school (SF)
multiply (x)	Area of complex (SF)
equal (=)	AVERAGE HEATING (COMPLEX) (mbtuh)
add (+)	AVE STEAM FOR DOM. WATER (mbtuh)
add (+)	AVE STEAM FOR DEAERATOR (mbtuh)
add (+)	AVERAGE STEAM PIPE LOSS (mbtuh)
equal (=)	AVERAGE STEAM PRODUCTION (mbtuh)
multiply (x)	1,000,000 btu/mbtu
divide (/)	907.8 btu/lb (Latent heat of evaporation)
equal (=)	AVERAGE STEAM PRODUCTION (lbs/hr)

CALCULATE BOILER FIRING TIME

IF up to 30,000 lbs/hr: Boiler-1 on, Boiler-2 off, Boiler-3 off
IF 30,001 lbs/hr to 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 off
IF greater than 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 on

	# BOILERS FIRING
multiply (x)	Days in month x 24 hours per day
equal (=)	BOILER FIRING TIME (hours)

CALCULATE STEAM PIPE LOSS

	-23,109	mbtu (pipe loss per year from 'Steam Dist. Study')
divide (/)	12	months per year
equal (=)	-1,926	mbtu (STEAM PIPE LOSS)
divide (/)	(30*24)	(30 days per month, 24 hours per day)
equal (=)	-2.67	mbtuh (STEAM PIPE LOSS)

CALCULATE ELECTRICAL COST PER YEAR

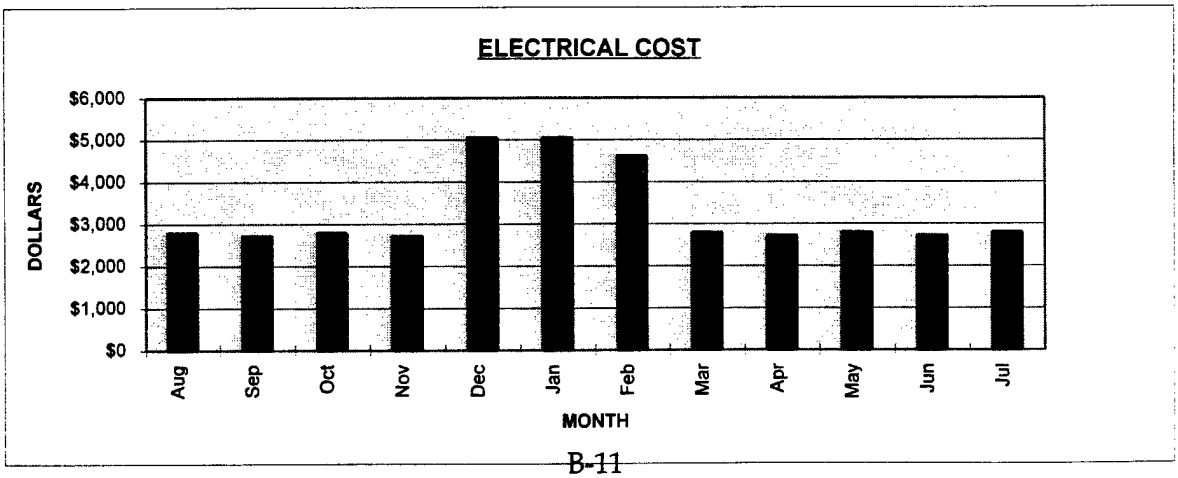
(2) 25hp fans per boiler	32.64	kw (boilers)
(1) 15 hp pump per boiler (+)	10.08	kw (pump)
equal (=)	42.72	kw (per boiler)
multiply (x)	10,920	BOILER FIRING TIME (hours)
equal (=)	466,502	kwh
Cost of electricity (x)	0.0711	$/kwh
equal (=)	$33,168	(Electrical rate cost)
peak electrical load	42.72	kw (per boiler)
multiply (x)	2	boilers firing
equal (=)	85	kw (peak demand)
demand charge (x)	6.25	$/kw
equal (=)	$6,408	(Electrical demand charge)
	$33,168	(Electrical rate cost)
add (+)	$6,408	(Electrical demand charge)
equal (=)	$39,576	(Total Electrical Cost)

CALCULATE STEAM FOR DOMESTIC WATER

	2,207	STEAM FOR DOM. WATER [Complex] (mbtu)
divide (/)	720	(30 Days per month x 24 hours per day)
equal (=)	3.07	AVE STEAM FOR DOM. WATER (mbtuh)

CALCULATE STEAM FOR DEAERATOR

	AVERAGE HEATING (COMPLEX) (mbtuh)
add (+)	AVE STEAM FOR DOM. WATER (mbtuh)
add (+)	AVERAGE STEAM PIPE LOSS (mbtuh)
equal (=)	Average steam usage (mbtuh)
multiply (x)	10%, Industry standard
equal (=)	AVE STEAM FOR DEAERATOR (mbtuh)



EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, Co 80227

ANNUAL CENTRAL PLANT ELECTRICITY USAGE
(ABANDONED BUILDINGS HEATED TO 45F)

#1406.003
Ft. Greely Utility Study
3/15/96
JvS

BOILER FIRING TIME

MONTH Aug '94 to Jul '95	AVERAGE HEATING (SCHOOL) (mbtuh)	AVERAGE HEATING (ABANDONED) (mbtuh)	AVERAGE HEATING (ACTIVE) (mbtuh)	AVE STEAM FOR DOM. WATER (mbtuh)	AVE STEAM FOR DEAERATOR (mbtuh)	AVERAGE STEAM PIPE LOSS (mbtuh)	AVERAGE STEAM PRODUCTION (mbtuh)	AVERAGE STEAM PRODUCTION (lbs/hr)	# BOILERS FIRING (average)	# DAYS	BOILER FIRING TIME (hours)
Aug	0.005	0.12	0.90	0.63	0.16	2.67	4.5	4,938	1	31	744
Sep	0.042	0.97	1.41	0.63	0.30	2.67	6.0	6,592	1	30	720
Oct	0.212	4.88	2.49	0.63	0.80	2.67	11.5	12,638	1	31	744
Nov	0.443	10.19	3.70	0.63	1.45	2.67	18.6	20,534	1	30	720
Dec	0.631	14.52	4.60	0.63	1.97	2.67	24.4	26,866	1	31	744
Jan	0.674	15.51	4.89	0.63	2.10	2.67	25.8	28,418	1	31	744
Feb	0.592	13.62	4.44	0.63	1.87	2.67	23.2	25,590	1	28	672
Mar	0.457	10.51	3.66	0.63	1.48	2.67	19.0	20,884	1	31	744
Apr	0.266	6.12	2.65	0.63	0.94	2.67	13.0	14,338	1	30	720
May	0.077	1.77	1.53	0.63	0.39	2.67	7.0	7,704	1	31	744
Jun	0.015	0.35	1.05	0.63	0.20	2.67	4.9	5,399	1	30	720
Jul	0.003	0.07	0.85	0.63	0.16	2.67	4.4	4,825	1	31	744
TOTAL											8,760

CALCULATE AVERAGE STEAM PRODUCTION

	AVERAGE HEATING (SCHOOL) (mbtuh) [Calculated]
divide (/)	Area of school (SF)
multiply (x)	Area of abandoned (SF)
equal (=)	AVERAGE HEATING (ABANDONED) (mbtuh)
add (+)	AVERAGE HEATING (MODIFIED) (mbuth)
add (+)	AVE STEAM FOR DOM. WATER (mbtuh)
add (+)	AVE STEAM FOR DEAERATOR (mbtuh) (Calculated)
add (+)	AVERAGE STEAM PIPE LOSS (mbtuh) (Calculated)
equal (=)	AVEREAGE STEAM PRODUCTION (mbtuh)
multiply (x)	1,000,000 btu/mbtu
divide (/)	907.8 btu/lb (Latent heat of evaporation)
equal (=)	AVERAGE STEAM PRODUCTION (lbs/hr)

CALCULATE BOILER FIRING TIME

IF up to 30,000 lbs/hr: Boiler-1 on, Boiler-2 off, Boiler-3 off
IF 30,001 lbs/hr to 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 off
IF greater than 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 on

	# BOILERS FIRING
multiply (x)	Days in month x 24 hours per day
equal (=)	BOILER FIRING TIME (hours)

CALCULATE STEAM PIPE LOSS

	-23,109	mbtu (pipe loss per year from 'Steam Dist. Study')
divide (/)	12	months per year
equal (=)	-1,926	mbtu (STEAM PIPE LOSS)
divide (/)	(30*24)	(30 days per month, 24 hours per day)
equal (=)	-2.67	mbtuh (STEAM PIPE LOSS)

CALCULATE ELECTRICAL COST PER YEAR

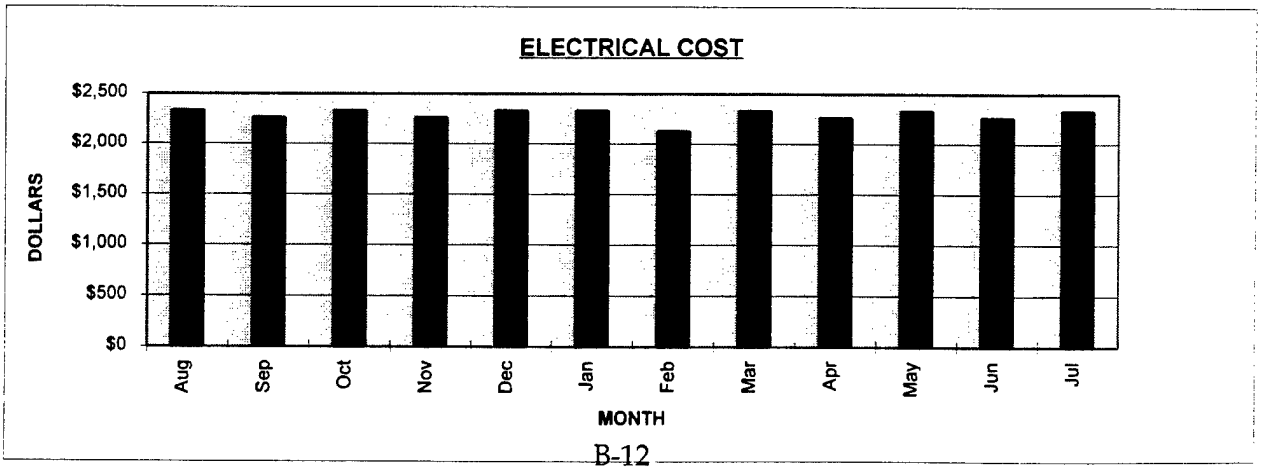
(2) 25hp fans per boiler	32.64	kw (boilers) [From 'Boiler Efficiency Study']
(1) 10 hp pump per boiler (+)	6.72	kw (pump)
equal (=)	39.36	kw (per boiler)
multiply (x)	8,760	BOILER FIRING TIME (hours)
equal (=)	344,794	kwh
Cost of electricity (x)	0.0711	$/kwh
equal (=)	$24,515	(Electrical rate cost)
ave electrical load	39.36	kw (per boiler)
multiply (x)	1	boilers firing
equal (=)	39	kw (peak demand)
demand charge (x)	6.25	$/kw
equal (=)	$2,952	(Electrical demand charge)
	$24,515	(Electrical rate cost)
add (+)	$2,952	(Electrical demand charge)
equal (=)	$27,467	(Total Electrical Cost)

CALCULATE STEAM FOR DOMESTIC WATER

	AVE STEAM FOR DOM. WATER [Complex] (mbtuh)
divide (/)	Area of complex (SF)
multiply (x)	Area of modified (SF)
equal (=)	AVE STEAM FOR DOM. WATER [Modified] (mbtuh)

CALCULATE STEAM FOR DEAERATOR

	AVERAGE HEATING (ABANDONED) (mbtuh)
add (+)	AVERAGE HEATING (MODIFIED) (mbtuh)
add (+)	AVE STEAM FOR DOM. WATER (mbtuh)
add (+)	AVERAGE STEAM PIPE LOSS (mbtuh)
equal (=)	Average steam usage (mbtuh)
multiply (x)	10%, Industry standard
equal (=)	AVE STEAM FOR DEAERATOR (mbtuh)



EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, Co 80227

ANNUAL CENTRAL PLANT ELECTRICITY USAGE
(ABANDONED BUILDINGS UNHEATED)

#1406.003
Ft. Greely Utility Study
3/15/96
JvS

BOILER FIRING TIME

MONTH Aug '94 to Jul '95	AVERAGE HEATING (SCHOOL) (mbtuh)	AVERAGE HEATING (ACTIVE) (mbtuh)	AVE STEAM FOR DOM. WATER (mbtuh)	AVE STEAM FOR DEAERATOR (mbtuh)	AVERAGE STEAM PIPE LOSS (mbtuh)	AVERAGE STEAM PRODUCTION (mbtuh)	AVERAGE STEAM PRODUCTION (lbs/hr)	# BOILERS FIRING (average)	# DAYS	BOILER FIRING TIME (hours)
August	0.191	0.90	0.63	0.15	2.67	4.4	4,798	1	31	744
September	0.300	1.41	0.63	0.20	2.67	4.9	5,421	1	30	720
October	0.529	2.49	0.63	0.31	2.67	6.1	6,729	1	31	744
November	0.784	3.70	0.63	0.43	2.67	7.4	8,185	1	30	720
December	0.975	4.60	0.63	0.52	2.67	8.4	9,276	1	31	744
January	1.037	4.89	0.63	0.55	2.67	8.7	9,630	1	31	744
February	0.942	4.44	0.63	0.51	2.67	8.2	9,088	1	28	672
March	0.777	3.66	0.63	0.43	2.67	7.4	8,145	1	31	744
April	0.563	2.65	0.63	0.33	2.67	6.3	6,923	1	30	720
May	0.324	1.53	0.63	0.22	2.67	5.0	5,558	1	31	744
June	0.223	1.05	0.63	0.17	2.67	4.5	4,981	1	30	720
July	0.181	0.85	0.63	0.15	2.67	4.3	4,889	1	31	744
TOTAL										8,760

CALCULATE AVERAGE STEAM PRODUCTION

	AVERAGE HEATING (SCHOOL) (mbtuh) [Calculated]	
divide (/)	Area of school (SF)	
multiply (x)	Area of modified (SF)	
equal (=)	AVERAGE HEATING (MODIFIED) (mbtuh)	
add (+)	AVE STEAM FOR DOM. WATER (mbtuh)	
add (+)	AVE STEAM FOR DEAERATOR (mbtuh)	
add (+)	AVERAGE STEAM PIPE LOSS (mbtuh)	
equal (=)	AVERAGE STEAM PRODUCTION (mbtuh)	
multiply (x)	1,000,000 btu/mbtu	
divide (/)	907.8 btu/lb (Latent heat of evaporation)	
equal (=)	AVERAGE STEAM PRODUCTION (lbs/hr)	

CALCULATE BOILER FIRING TIME

IF up to 30,000 lbs/hr: Boiler-1 on, Boiler-2 off, Boiler-3 off
IF 30,001 lbs/hr to 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 off
IF greater than 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 on

	# BOILERS FIRING	
multiply (x)	Days in month x 24 hours per day	
equal (=)	BOILER FIRING TIME (hours)	

CALCULATE STEAM PIPE LOSS

	-23,109	mbtu (pipe loss per year from 'Steam Dist. Study')
divide (/)	12	months per year
equal (=)	-1,926	mbtu (STEAM PIPE LOSS)
divide (/)	(30*24)	(30 days per month, 24 hours per day)
equal (=)	-2.67	mbtuh (STEAM PIPE LOSS)

CALCULATE ELECTRICAL COST PER YEAR

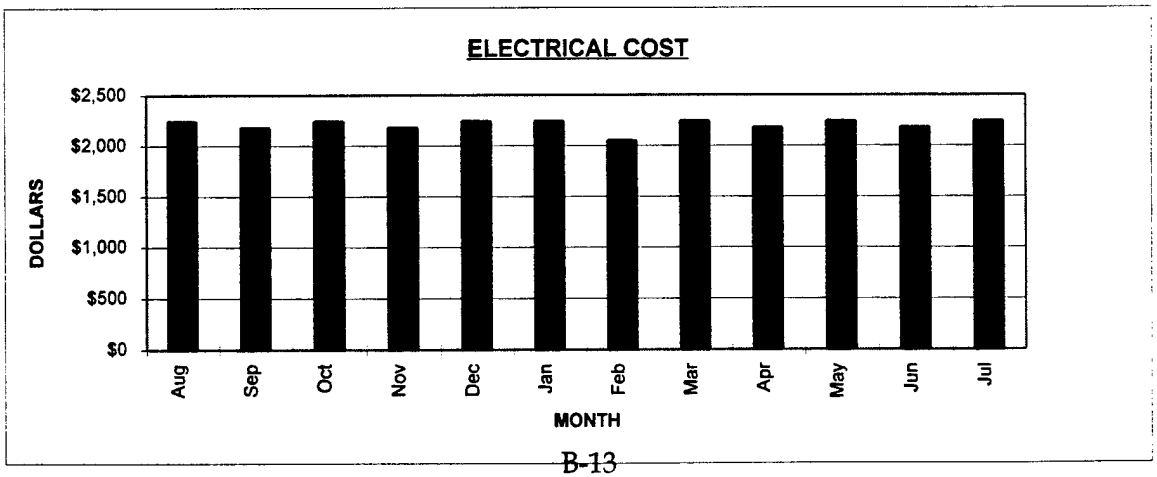
(2) 25hp fans per boiler	32.64	kw (boilers)
(1) 7 1/2 hp pump (+)	5.28	kw (pump)
equal (=)	37.92	kw (per boiler)
multiply (x)	8,760	boiler firing hours
equal (=)	332,179	kwh
Cost of electricity (x)	0.0711	$/kwh
equal (=)	$23,618	(Electrical rate cost)
ave electrical load	37.92	kw (per boiler)
multiply (x)	1	boilers firing
equal (=)	38	kw (total demand)
demand charge (x)	6.25	$/kw
equal (=)	$2,844	(Electrical demand charge)
	$23,618	(Electrical rate cost)
add (+)	$2,844	(Electrical demand charge)
equal (=)	$26,462	(Total electrical cost)

CALCULATE STEAM FOR DOMESTIC WATER

	AVE STEAM FOR DOM. WATER [Complex] (mbtuh)
divide (/)	Area of complex (SF)
multiply (x)	Area of modified (SF)
equal (=)	AVE STEAM FOR DOM. WATER [Modified] (mbtuh)

CALCULATE STEAM USED FOR DEAERATOR

	AVERAGE HEATING (MODIFIED) (mbtuh)
add (+)	AVE STEAM FOR DOM. WATER (mbtuh)
add (+)	AVERAGE STEAM PIPE LOSS (mbtuh)
equal (=)	Average steam usage (mbtuh)
multiply (x)	10%, industry standard
equal (=)	AVE STEAM FOR DEAERATOR (mbtuh)



EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, Co 80227

ANNUAL CENTRAL PLANT ELECTRICITY USAGE
(ABANDONED BUILDINGS UNHEATED)
(SELECTED STEAM PIPING ABANDONED)

#1406.003
Ft. Greely Utility Study
3/15/96
JvS

BOILER FIRING TIME

MONTH Aug '94 to Jul '95	AVERAGE HEATING (SCHOOL) (mbtuh)	AVERAGE HEATING (MODIFIED) (mbtuh)	AVE STEAM FOR DOM. WATER (mbtuh)	AVE STEAM FOR DEAERATOR (mbtuh)	AVERAGE STEAM PIPE LOSS (mbtuh)	AVERAGE STEAM PRODUCTION (mbtuh)	AVERAGE STEAM PRODUCTION (lbs/hr)	# BOILERS FIRING (average)	# DAYS	BOILER FIRING TIME (hours)
August	0.191	0.90	0.63	0.26	1.11	2.9	3,197	1	31	744
September	0.300	1.41	0.63	0.32	1.11	3.5	3,819	1	30	720
October	0.529	2.49	0.63	0.42	1.11	4.7	5,127	1	31	744
November	0.784	3.70	0.63	0.54	1.11	6.0	6,584	1	30	720
December	0.975	4.60	0.63	0.63	1.11	7.0	7,675	1	31	744
January	1.037	4.89	0.63	0.66	1.11	7.3	8,029	1	31	744
February	0.942	4.44	0.63	0.62	1.11	6.8	7,486	1	28	672
March	0.777	3.66	0.63	0.54	1.11	5.9	6,544	1	31	744
April	0.563	2.65	0.63	0.44	1.11	4.8	5,321	1	30	720
May	0.324	1.53	0.63	0.33	1.11	3.6	3,956	1	31	744
June	0.223	1.05	0.63	0.28	1.11	3.1	3,380	1	30	720
July	0.181	0.85	0.63	0.26	1.11	2.9	3,140	1	31	744
TOTAL										8,760

CALCULATE AVERAGE STEAM PRODUCTION

	AVERAGE HEATING (SCHOOL) (mbtuh) [Calculated]
divide (/)	Area of school (SF)
multiply (x)	Area of modified (SF)
equal (=)	AVERAGE HEATING (MODIFIED) (mbtuh)
add (+)	AVE STEAM FOR DOM. WATER (mbtuh)
add (+)	AVE STEAM FOR DEAERATOR (mbtuh)
add (+)	AVERAGE STEAM PIPE LOSS (mbtuh)
equal (=)	AVERAGE STEAM PRODUCTION (mbtuh)
multiply (x)	1,000,000 btu/mbtu
divide (/)	907.8 btu/lb (Latent heat of evaporation)
equal (=)	AVERAGE STEAM PRODUCTION (lbs/hr)

CALCULATE TIME BOILERS FIRING

IF up to 30,000 lbs/hr: Boiler-1 on, Boiler-2 off, Boiler-3 off
IF 30,001 lbs/hr to 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 off
IF greater than 60,000 lbs: Boiler-1 on, Boiler-2 on, Boiler-3 on

	# BOILERS FIRING
multiply (x)	Days in month x 24 hours per day
equal (=)	BOILER FIRING TIME (hours)

CALCULATE STEAM PIPE LOSS

	-9,589	mbtu (pipe loss per year) [Calculated]
divide (/)	12	months per year
equal (=)	-799	mbtu (STEAM PIPE LOSS)
divide (/)	(30*24)	(30 days per month, 24 hours per day)
equal (=)	-1.11	mbtuh (STEAM PIPE LOSS)

CALCULATE ELECTRICAL COST PER YEAR

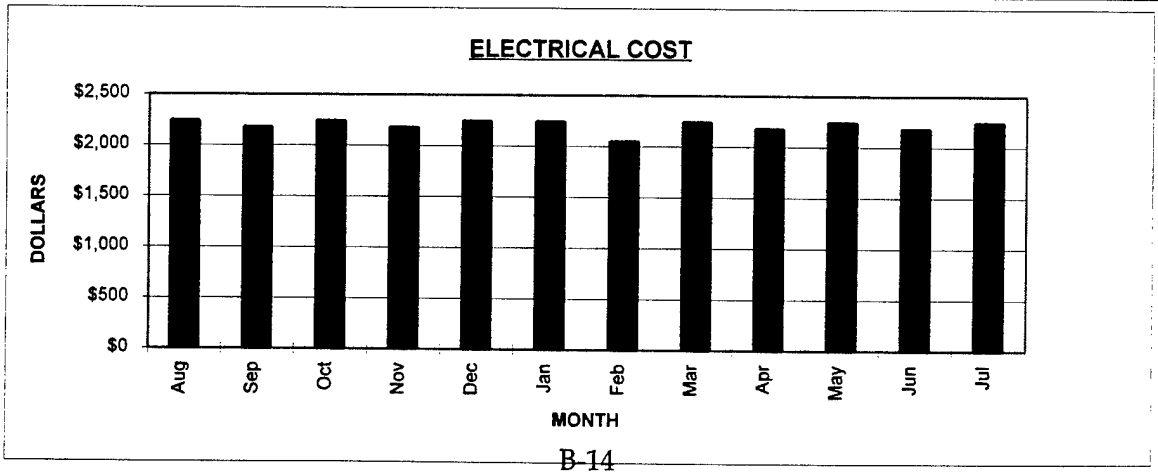
(2) 25hp fans per boiler	32.64	kw (boilers)
(1) 7 1/2 hp pump (+)	5.28	kw (pump)
equal (=)	37.92	kw (per boiler)
multiply (x)	8,760	boiler firing hours
equal (=)	332,179	kwh
Cost of electricity (x)	0.0711	$/kwh
equal (=)	$23,618	(Electrical rate cost)
ave electrical load	37.92	kw (per boiler)
multiply (x)	1	boilers firing
equal (=)	38	kw (total demand)
demand charge (x)	6.25	$/kw
equal (=)	$2,844	(Electrical demand charge)
	$23,618	(Electrical rate cost)
add (+)	$2,844	(Electrical demand charge)
equal (=)	$26,462	(Total electrical cost)

CALCULATE STEAM FOR DOMESTIC WATER

	AVE STEAM FOR DOM. WATER [Complex] (mbtuh)
divide (/)	Area of complex (SF)
multiply (x)	Area of modified (SF)
equal (=)	AVE STEAM FOR DOM. WATER [Modified] (mbtuh)

CALCULATE STEAM FOR DEAERATOR

	AVERAGE HEATING (MODIFIED) (mbtuh)
add (+)	AVE STEAM FOR DOM. WATER (mbtuh)
add (+)	AVERAGE STEAM PIPE LOSS (mbtuh)
equal (=)	Average steam usage (mbtuh)
multiply (x)	10%, Industry standard
equal (=)	AVE STEAM FOR DEAERATOR (mbtuh)



EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, Co 80227

DISTRIBUTED BOILERS
(ABANDONED BUILDINGS UNHEATED)

Area of Ft. Greely school: 54,604 SF

ENERGY COSTS

BLDG. #	BUILDING DESCRIPTION	PEAK STEAM PRODUCTION (mbh)	15 PSIG BOILER SELECTION (Burnham Boiler Co.)	INPUT (mbh)	NET OUTPUT (mbh)	BLOWER SIZE (hp)	COND. PUMP SIZE (hp)	PEAK ELEC. DEMAND (kw)	ELECT USAGE (kwh)	ELECT COST ($)
501	POST HQ	754	EXISTING			1/2	1/3	2.04	17,870	1271
503	GYMNASIUM	1083	V-912	1,764	1,445	1/2	1/3	2.04	17,870	1271
504	FIRE STATION	245	V-904	490	404	1/3	1/3	1.73	15,137	1076
605	CONSOLIDATED PW	984	V-911	1,596	1,314	1/2	1/3	2.52	22,075	1570
606	CENTRAL HEATING PLANT	1238	PF-514	1,960	1,612	1/2	1/3	2.52	22,075	1570
612	TANK MAINTENANCE	738	V-909	1,274	1,054	1/2	1/3	2.52	22,075	1570
615	MOTOR POOL	685	V-909	1,274	1,054	1/2	1/3	2.04	17,870	1271
658	TEMP MOTOR POOL	1004	V-912	1,764	1,445	1/2	1/3	2.04	17,870	1271
725	SCHOOL	2157	PF-516	3,150	2,604	2	1/3	3.74	32,797	2332
820	HOUSING UNIT	639	V-908	1,120	924	1/2	1/3	2.04	17,870	1271
821	HOUSING UNIT	639	V-908	1,120	924	1/2	1/3	2.04	17,870	1271
TOTALS				15,512	12,780			25.27	221,383	15,740

NOTE: Boiler firing time equal to 8,760 hours for each boiler

CALCULATE PEAK STEAM PRODUCTION

	PEAK HEATING [Complex] (mbtuh)
divide (/)	Area of school (SF)
multiply (x)	Area of bldg (SF)
equal (=)	PEAK HEATING (BLDG) (mbtuh)
add (+)	PEAK STEAM FOR DOM. WATER (mbtuh)
equal (=)	PEAK STEAM PRODUCTION (mbtuh)

CALCULATE PEAK ELECTRICAL DEMAND

	25.27	kw
Cost of electricity (x)	6.25	$/kw
multiply (x)	12	months
equal (=)	$1,895	(Electrical demand charge)
	$15,740	(Electrical rate cost)
add (+)	$1,895	(Electrical demand charge)
equal (=)	$17,636	(Total electrical cost)

CALCULATE TOTAL ENERGY COST

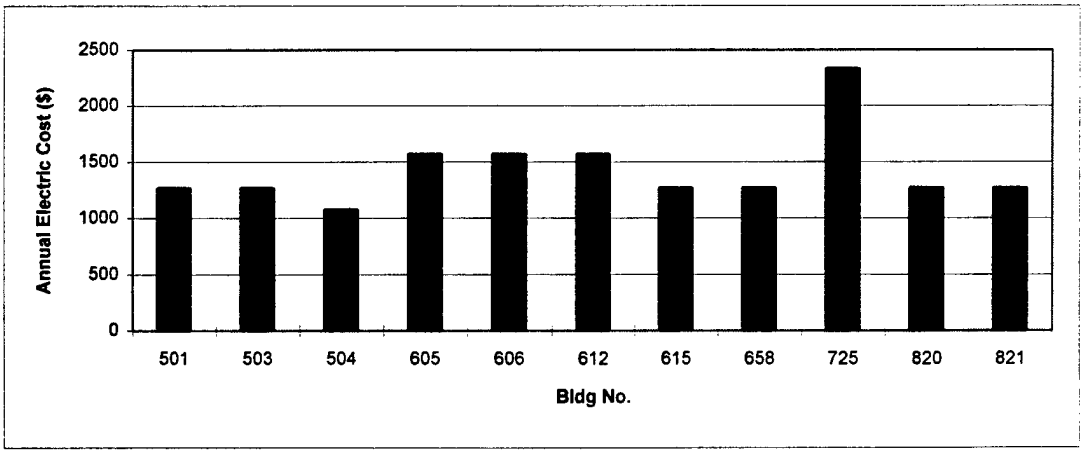
	$197,580	Fuel oil cost
add (+)	$17,636	Electricity cost
add (+)	$934,400	Manpower cost
equal (=)	$1,149,616	Total Energy Cost

CALCULATE PEAK ELEC. DEMAND

	(Blower amps + Cond. pump amps)
multiply (x)	120 votls
divide (/)	1,000 watts/kilowatt
equal (=)	PEAK ELEC. DEMAND (kw)

CALCULATE ELECT RATE COST

	PEAK ELEC. DEMAND (kw)
multiply (x)	8,760 Hours per year
equal (=)	ELECT USAGE (kwh)
multiply (x)	$0.0711/kwh
equal (=)	ELECT RATE COST ($)



EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, CO 80227

FUEL OIL SYSTEMS FOR BOILERS

BUILDING NUMBER	BUILDING DESCRIPTION	SQFT	CLASSIFICATION	MAXIMUM FUEL OIL USAGE (GPH)	FUEL TANK SIZE (GAL)	DAYS OF PEAK OPERATION
501	POST HQ	19,095	OFFICE	N/A	EXISTING	
503	GYMNASIUM	27,430	GYM	12.6	5000	17
504	FIRE STATION	6,192	FIRE STATION	3.5	1000	12
605	CONSOLIDATED PW	24,915	OFFICE	11.4	5000	18
606	CENTRAL HEATING PLAN	31,333	UTILITY	14.0	5000	15
612	TANK MAINTENANCE	18,681	MAINTENANCE	9.1	5000	23
615	ROADS AND GROUNDS	17,351	MAINTENANCE	9.1	5000	23
658	TEMP MOTOR POOL	25,425	MAINTENANCE	12.6	5000	17
725	SCHOOL	54,604	SCHOOL	22.5	10000	19
820	HOUSING UNIT	16,175	BARRACKS/HSG	8.0	5000	26
821	HOUSING UNIT	16,175	BARRACKS/HSG	8.0	5000	26
633	SEWAGE TREATMENT	2,784	UTILITY	N/A		N/A
	TOTAL	260,160 sf				

FUEL OIL STORAGE COMPONENTS

1) 660 gal fuel oil storage tank in each building

SPECIFICATIONS

Burnham®
AMERICA'S BOILER COMPANY

V9 RATINGS

BOILER MODEL (1)	BOILER HORSEPOWER	GROSS OUTPUT MBH	NET I=B=R RATING (2)			BURNER INPUT		HEATING SURFACE (SQ. FT.)		NET FIREBOX VOLUME (CU. FT.)	PRESSURE IN FIREBOX (INCHES WTR. COLUMN) (3)
			SQ. FT STEAM	MBH STEAM	MBH WATER	OIL (GPH)	GAS (MBH)	STEAM	WATER		
V-903	9.3	311	971	233	270	2.75	397	34	37	3.2	.28
V-904	12.1	404	1263	303	351	3.5	505	48	54	4.8	.29
V-905	16.0	534	1671	401	464	4.6	668	62	71	6.4	.20
V-906	19.8	664	2075	498	577	5.8	830	77	88	7.9	.29
V-907	23.7	794	2483	596	690	6.9	992	91	105	9.5	.26
V-908	27.6	924	2888	693	803	8.0	1155	105	122	11.0	.29
V-909	31.5	1054	3296	791	917	9.1	1317	119	139	12.6	.28
V-910	35.4	1184	3700	888	1030	10.2	1479	134	156	14.2	.28
V-911	39.3	1314	4125	990	1143	11.4	1642	148	173	15.7	.28
V-912	43.2	1445	4579	1099	1257	12.6	1804	162	190	17.3	.30

(1) Suffix "S" indicates steam boiler, "W" indicates water boiler. Suffix "G" indicates gas-fired, "O" indicates oil-fired. "GO" indicates combination gas-oil fired.

(2) I = B = R net ratings shown are based on piping and pickup allowances which vary from 1.333 to 1.315 for steam and 1.15 for water. Consult manufacturer for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping systems, etc. The I = B = R burner capacity in GPH is based on oil having a heat value of 140,000 BTU per gallon.

(3) Boiler ratings are based on 12.5% CO_2, + .10" water column pressure at boiler flue outlet. Ratings shown above apply at all altitudes up to 1000 feet on oil and 2000 feet on gas. For altitudes above those indicated, the ratings should be reduced at the rate of 4% for each 1000 feet above sea level.

NOTE: Maximum Allowable Working Pressure—

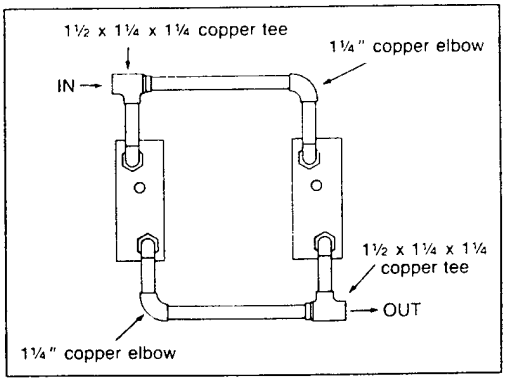
Steam	15 PSI
Water (USA Standard)	50 PSI
Water (USA Optional)	70 PSI
Water (Canada)	45 PSI

TANKLESS HEATER RATINGS (Water & Steam)

BOILER MODEL	NUMBER OF V9-2 TANKLESS* HEATERS INSTALLED			
	1	2	3	4
V-903	6.0	–	–	–
V-904	7.5	–	–	–
V-905	7.5	–	–	–
V-906	7.5	13	–	–
V-907	7.5	15	–	–
V-908	7.5	15	–	–
V-909	7.5	15	21	–
V-910	7.5	15	22.5	–
V-911	7.5	15	22.5	–
V-912	7.5	15	22.5	28.5

*Ratings are given in gallons per minute continuous flow of water heated from 40°F to 140°F with 200°F boiler water.

Two Heater Manifold



Burnham®
Lancaster PA 17604

Form No. 4526-A-11/91-30Ma
Printed in U.S.A.

SPECIFICATIONS

PF-5 RATINGS

Boiler Number (1)	Boiler H.P.	Gross I=B=R Output MBH	Net I=B=R Rating (2) Steam Sq. Ft.	Net I=B=R Rating (2) Steam MBH	Net I=B=R Rating (2) Water MBH (3)	I=B=R Burner Capacity Light Oil GPH (4)	I=B=R Burner Capacity Gas MBH	Net Firebox Volume Ft.³	Pressure in Firebox (Inches Water Column) (5)	Heating Surface Ft.² Steam	Heating Surface Ft.² Water	Water Content Gal. Steam	Water Content Gal. Water
PF-504	18.5	620	1938	465	539	5.5	790	8.5	.244	57.45	66.12	58	70
PF-505	23.4	785	2454	589	683	6.9	997	11.1	.244	73.44	85.00	69	84
PF-506	28.4	951	2971	713	827	8.3	1204	13.7	.245	89.43	103.88	81	98
PF-507	33.3	1116	3488	837	970	9.8	1412	16.3	.245	105.42	122.76	92	112
PF-508	38.2	1281	4013	963	1114	11.2	1619	18.9	.246	121.41	141.64	104	127
PF-509	43.2	1446	4583	1100	1257	12.6	1826	21.4	.246	137.40	160.52	115	141
PF-510	48.2	1612	5158	1238	1402	14.0	2033	24.1	.247	153.39	179.40	126	156
PF-511	53.1	1777	5725	1374	1545	15.6	2240	26.8	.247	169.38	198.28	138	170
PF-512	58.1	1942	6283	1508	1689	17.0	2448	29.4	.248	185.37	217.16	149	184
PF-513	63.0	2108	6821	1637	1833	18.4	2655	32.0	.248	201.36	236.04	161	198
PF-514	67.9	2273	7354	1765	1977	19.8	2862	34.6	.249	217.35	254.92	172	212
PF-515	72.9	2438	7888	1893	2120	21.5	3069	37.2	.249	233.34	273.80	184	226
PF-516	77.8	2604	8425	2022	2264	22.5	3276	39.8	.250	249.33	292.68	195	240
PF-517	82.7	2769	8958	2150	2408	24.0	3484	42.4	.250	265.32	311.56	207	255
PF-518	87.7	2934	9492	2278	2551	25.5	3691	45.0	.251	281.31	330.44	218	270
PF-519	92.6	3099	10025	2406	2695	27.0	3898	47.6	.251	297.30	349.32	230	280
PF-520	97.4	3265	10563	2535	2839	28.5	4105	50.2	.252	313.29	368.20	241	298
PF-521	102.5	3430	11096	2663	2983	30.0	4312	52.8	.252	329.28	387.08	253	312

1. Suffix "S" indicates steam boiler, "W" indicates water boiler. Suffix "G" indicates gas-fired, "O" oil fired and "GO" for combination gas-oil fired.
2. I=B=R net ratings shown are based on piping and pick up allowances which vary from 1.333 to 1.288 for steam and 1.15 for water.
3. Net ratings for water, square feet, are based on 170°F average water temperature in system.

   For higher water temperatures, select boiler on basis of I=B=R Net Ratings, MBH.
4. The I=B=R burner capacity in GPH is based on oil having a heat value of 140,000 BTU per gallon.

NOTE: Water Working Pressure—Steam 15 PSI W.P.
Water 50 PSI W.P.
Water (Optional) 70 PSI W.P.

5. Boiler ratings are based on 12¼% CO_2, +.10" water column pressure at boiler flue outlet.

   I=B=R vent diameter for Boiler No. PF-504 thru PF-508 is 10", for PF-509 - PF-515 is 14" and for PF-516 - PF-521 is 18".

   Consult manufacturer for installations having unusual piping and pick up requirements, such as intermittent system operation, extensive piping systems, etc.

   Ratings shown above apply at altitudes up to 1000 feet on oil and 2000 feet on gas. For altitudes above those indicated, the ratings should be reduced at the rate of 4% for each 1000 feet above sea level.

Burnham®
AMERICA'S BOILER COMPANY
BURNHAM CORPORATION

Form No. 4256-B-6/93-20Mf
Printed in U.S.A.

APPENDIX C

BUILDING LOAD BACK-UP CALCULATIONS

#1496.003
FT GREELY
11.20.95

DOE-2.1D

BUILDING ENERGY ANALYSIS PROGRAM

DEVELOPED BY
LAWRENCE BERKELEY LABORATORY/UNIVERSITY OF CALIFORNIA
AND
James J. Hirsch/HIRSCH & ASSOCIATES/(805) 482-5515

FT GREELY SCHOOL
SPACE AT 70F

WITH MAJOR SUPPORT FROM
UNITED STATES DEPARTMENT OF ENERGY
ASSISTANT SECRETARY FOR CONSERVATION AND RENEWABLE ENERGY
OFFICE OF BUILDINGS AND COMMUNITY SYSTEMS
BUILDING SYSTEMS DIVISION

LBL RELEASE DEC 1990 version : JJHirsch PC 2.1D-017
Elite Software PC DOE-2.1D released in April 1993.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:24:10 LDL RUN 1
DENVER, CO 80227
REPORT- LV-A GENERAL PROJECT AND BUILDING INPUT BIG DELTA, AK

PERIOD OF STUDY

STARTING DATE	ENDING DATE	NUMBER OF DAYS
1 JAN 1995	31 DEC 1995	365

SITE CHARACTERISTIC DATA

STATION NAME	LATITUDE (DEG)	LONGITUDE (DEG)	ALTITUDE (FT)	TIME ZONE	BUILDING AZIMUTH (DEG)
BIG DELTA, AK	64.5	145.6	0.	9 AST	0.0

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:24:10 LDL RUN 1
DENVER, CO 80227
REPORT- LV-B SUMMARY OF SPACES OCCURRING IN THE PROJECT BIG DELTA, AK

NUMBER OF SPACES 6 EXTERIOR 6 INTERIOR 0

SPACE	SPACE MULT	SPACE TYPE	AZIMUTH	LIGHTING (WATT / SQFT)	PEOPLE	EQUIP (WATT / SQFT)	INFILTRATION METHOD	AIR CHANGES PER HOUR	AREA (SQFT)	VOLUME (CUFT)
INTERIOR_C	1.0	EXT	0.0	0.75	150.0	0.00	AIR-CHANGE	1.00	20342.00	183078.00
EXTER_ZN_C	1.0	EXT	0.0	1.00	150.0	0.00	AIR-CHANGE	1.00	8829.00	79461.00
KITCHEN	1.0	EXT	0.0	0.70	5.0	0.00	AIR-CHANGE	1.00	910.00	8190.00
GYM	1.0	EXT	0.0	0.50	75.0	0.00	AIR-CHANGE	1.00	8150.00	203750.00
ADJ_TO_GYM	1.0	EXT	0.0	0.60	35.0	0.00	AIR-CHANGE	1.00	7097.00	63873.00
DIN&MP	1.0	EXT	0.0	0.75	150.0	0.00	AIR-CHANGE	1.00	4900.00	98000.00
BUILDING TOTALS					565.0				50228.00	636352.00

DATA FOR SPACE INTERIOR_C

LOCATION OF ORIGIN IN BUILDING COORDINATES			SPACE AZIMUTH	SPACE	HEIGHT	AREA	VOLUME
XB (FT)	YB (FT)	ZB (FT)	(DEG)	MULTIPLIER	(FT)	(SQFT)	(CUFT)
0.00	0.00	0.00	0.00	1.0	9.00	20342.00	183078.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
4	1	2	1	NO	NO

NUMBER OF SUBSURFACES

EXTERIOR			INTERIOR
TOTAL	WINDOWS	DOORS	WINDOWS
0	0	0	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
70.0	70.0

INFILTRATION

SCHEDULE	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR	HEIGHT TO NEUTRAL ZONE (FT)
INFL_ACTIV	AIR-CHANGE	0.00	1.00	0.0

PEOPLE

SCHEDULE	NUMBER	AREA PER PERSON (SQFT)	PEOPLE ACTIVITY (BTU/HR)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
OCCUP	150.0	135.6	0.0	230.0	190.0

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DENVER, CO 80227
REPORT- LV-C DETAILS OF SPACE INTERIOR_C BIG DELTA, AK

LIGHTING

SCHEDULE	LIGHTING TYPE	LOAD (WATTS/ SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
LIGHT_ON	REC-FLUOR-RV	0.75	0.00	1.00

INTERIOR SURFACES (U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACE	SURFACE-TYPE
	10000.00	0RESWALL	20.000	EXTER_ZN_C	QUICK AIR
	2000.00	0RESWALL	20.000	DIN&MP	QUICK AIR

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	WIDTH (FT)	HEIGHT (FT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
	1.0	20449.00	143.00	143.00	ROOFCON	0.075	QUICK

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00

UNDERGROUND SURFACES (U-VALUE INCLUDES INSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)
	1.0	20449.00	FLOORCON	0.10

DATA FOR SPACE EXTER_ZN_C

LOCATION OF ORIGIN IN BUILDING COORDINATES

XB (FT)	YB (FT)	ZB (FT)	SPACE AZIMUTH (DEG)	SPACE MULTIPLIER	HEIGHT (FT)	AREA (SQFT)	VOLUME (CUFT)
0.00	0.00	0.00	0.00	1.0	9.00	8829.00	79461.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
7	5	1	1	NO	NO

NUMBER OF SUBSURFACES

TOTAL	EXTERIOR WINDOWS	EXTERIOR DOORS	INTERIOR WINDOWS
4	4	0	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
70.0	70.0

INFILTRATION

SCHEDULE	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR	HEIGHT TO NEUTRAL ZONE (FT)
INFL_ACTIV	AIR-CHANGE	0.00	1.00	0.0

PEOPLE

SCHEDULE	NUMBER	AREA PER PERSON (SQFT)	PEOPLE ACTIVITY (BTU/HR)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
OCCUP	150.0	58.9	0.0	230.0	190.0

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LIGHTING

SCHEDULE	LIGHTING TYPE	LOAD (WATTS/ SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
LIGHT_ON	REC-FLUOR-RV	1.00	0.00	1.00

OTHER EQUIPMENT

SCHEDULE	SOURCE TYPE	LOAD (BTU/HR)	FRACTION OF LOAD TO SPACE SENSIBLE	FRACTION OF LOAD TO SPACE LATENT
DHW_CLASS	HOT-WATER	45000.0	0.00	0.10

INTERIOR SURFACES (U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACE	SURFACE-TYPE
	10000.00	0RESWALL	20.000	INTERIOR_C	QUICK AIR

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	WIDTH (FT)	HEIGHT (FT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
	1.0	8836.00	94.00	94.00	ROOFCON	0.075	QUICK
	1.0	2304.00	256.00	9.00	WALL_CON	0.180	QUICK
	1.0	2439.00	271.00	9.00	WALL_CON	0.180	QUICK
	1.0	3294.00	366.00	9.00	WALL_CON	0.180	QUICK
	1.0	1629.00	181.00	9.00	WALL_CON	0.180	QUICK

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
	90.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	180.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	270.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00

UNDERGROUND SURFACES (U-VALUE INCLUDES INSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)
	1.0	8836.00	FLOORCON	0.10

EXTERIOR WINDOWS

WINDOW	MULTIPLIER	AREA (SQFT)	SHADING COEFF	NUMBER OF PANES	GLASS TYPE INDEX	SET-BACK (FT)	WIDTH (FT)	HEIGHT (FT)	SKY FORM FACTOR	GROUND FORM FACTOR
	43.0	21.00	1.00	1	5	0.00	7.00	3.00		
	25.0	21.00	1.00	1	5	0.00	7.00	3.00		
	57.0	21.00	1.00	1	5	0.00	7.00	3.00		
	23.0	21.00	1.00	1	5	0.00	7.00	3.00		

WINDOW	LOCATED IN SURFACE	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SURFACE COORDINATES X (FT)	Y (FT)
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00

DATA FOR SPACE KITCHEN

LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	SPACE AZIMUTH (DEG)	SPACE MULTIPLIER	HEIGHT (FT)	AREA (SQFT)	VOLUME (CUFT)
0.00	0.00	0.00	0.00	1.0	9.00	910.00	8190.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
4	2	1	1	NO	NO

NUMBER OF SUBSURFACES

TOTAL	EXTERIOR WINDOWS	DOORS	INTERIOR WINDOWS
0	0	0	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
70.0	70.0

INFILTRATION

SCHEDULE	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR	HEIGHT TO NEUTRAL ZONE (FT)
INFL_ACTIV	AIR-CHANGE	0.00	1.00	0.0

PEOPLE

SCHEDULE	NUMBER	AREA PER PERSON (SQFT)	PEOPLE ACTIVITY (BTU/HR)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
OCCUP	5.0	182.0	0.0	230.0	190.0

LIGHTING

SCHEDULE	LIGHTING TYPE	LOAD (WATTS/ SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
LIGHT_ON	REC-FLUOR-RV	0.70	0.00	1.00

OTHER EQUIPMENT

SCHEDULE	SOURCE TYPE	LOAD (BTU/HR)	FRACTION OF LOAD TO SPACE SENSIBLE	LATENT
DHW_CAFE	HOT-WATER	297500.0	0.10	0.20

INTERIOR SURFACES (U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACE	SURFACE-TYPE
	2000.00	0RESWALL	20.000	DIN&MP	QUICK AIR

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	WIDTH (FT)	HEIGHT (FT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
	1.0	1050.00	15.00	70.00	ROOFCON	0.075	QUICK
	1.0	150.00	15.00	10.00	WALL_CON	0.180	QUICK

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00

UNDERGROUND SURFACES (U-VALUE INCLUDES INSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)
	1.0	1050.00	FLOORCON	0.10

DATA FOR SPACE GYM

LOCATION OF ORIGIN IN BUILDING COORDINATES

XB (FT)	YB (FT)	ZB (FT)	SPACE AZIMUTH (DEG)	SPACE MULTIPLIER	HEIGHT (FT)	AREA (SQFT)	VOLUME (CUFT)
0.00	0.00	0.00	0.00	1.0	25.00	8150.00	203750.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
6	4	1	1	NO	NO

NUMBER OF SUBSURFACES

EXTERIOR TOTAL	EXTERIOR WINDOWS	EXTERIOR DOORS	INTERIOR WINDOWS
0	0	0	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
70.0	70.0

INFILTRATION

SCHEDULE	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR	HEIGHT TO NEUTRAL ZONE (FT)
GYM_INFL	AIR-CHANGE	0.00	1.00	0.0

PEOPLE

SCHEDULE	NUMBER	AREA PER PERSON (SQFT)	PEOPLE ACTIVITY (BTU/HR)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
OCCUP	75.0	108.7	0.0	400.0	800.0

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LIGHTING

SCHEDULE	LIGHTING TYPE	LOAD (WATTS/ SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
GYM_LIGHT	REC-FLUOR-RV	0.50	0.00	1.00

INTERIOR SURFACES (U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACE	SURFACE-TYPE
	2000.00	0RESWALL	20.000	ADJ_TO_GYM	QUICK AIR

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	WIDTH (FT)	HEIGHT (FT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
	1.0	6935.00	73.00	95.00	ROOFCON	0.075	QUICK
	1.0	2500.00	100.00	25.00	WALL_CON	0.180	QUICK
	1.0	100.00	5.00	20.00	WALL_CON	0.180	QUICK
	1.0	1640.00	82.00	20.00	WALL_CON	0.180	QUICK

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	180.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	270.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00

UNDERGROUND SURFACES (U-VALUE INCLUDES INSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)
	1.0	6935.00	FLOORCON	0.10

DATA FOR SPACE ADJ_TO_GYM

LOCATION OF ORIGIN IN BUILDING COORDINATES			SPACE AZIMUTH (DEG)	SPACE MULTIPLIER	HEIGHT (FT)	AREA (SQFT)	VOLUME (CUFT)
XB (FT)	YB (FT)	ZB (FT)					
0.00	0.00	0.00	0.00	1.0	9.00	7097.00	63873.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
7	5	1	1	NO	NO

NUMBER OF SUBSURFACES

TOTAL	EXTERIOR WINDOWS	DOORS	INTERIOR WINDOWS
0	0	0	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
70.0	70.0

INFILTRATION

SCHEDULE	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR	HEIGHT TO NEUTRAL ZONE (FT)
GYM_INFL	AIR-CHANGE	0.00	1.00	0.0

PEOPLE

SCHEDULE	NUMBER	AREA PER PERSON (SQFT)	PEOPLE ACTIVITY (BTU/HR)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
OCCUP	35.0	202.8	0.0	400.0	800.0

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LIGHTING

SCHEDULE	LIGHTING TYPE	LOAD (WATTS/ SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
LIGHT_ON	REC-FLUOR-RV	0.60	0.00	1.00

OTHER EQUIPMENT

SCHEDULE	SOURCE TYPE	LOAD (BTU/HR)	FRACTION OF LOAD TO SPACE SENSIBLE	FRACTION OF LOAD TO SPACE LATENT
DHW_GYM	HOT-WATER	28000.0	0.00	0.10

INTERIOR SURFACES (U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACE	SURFACE-TYPE
	2000.00	ORESWALL	20.000	GYM	QUICK AIR

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	WIDTH (FT)	HEIGHT (FT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
	1.0	6935.00	73.00	95.00	ROOFCON	0.075	QUICK
	1.0	522.00	58.00	9.00	WALL_CON	0.180	QUICK
	1.0	868.50	96.50	9.00	WALL_CON	0.180	QUICK
	1.0	1350.00	150.00	9.00	WALL_CON	0.180	QUICK
	1.0	135.00	15.00	9.00	WALL_CON	0.180	QUICK

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	90.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	180.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	270.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00

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UNDERGROUND SURFACES (U-VALUE INCLUDES INSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)
	1.0	6935.00	FLOORCON	0.10

DATA FOR SPACE DIN&MP

LOCATION OF ORIGIN IN BUILDING COORDINATES			SPACE AZIMUTH (DEG)	SPACE MULTIPLIER	HEIGHT (FT)	AREA (SQFT)	VOLUME (CUFT)
XB (FT)	YB (FT)	ZB (FT)					
0.00	0.00	0.00	0.00	1.0	20.00	4900.00	98000.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
6	3	2	1	NO	NO

NUMBER OF SUBSURFACES

EXTERIOR			INTERIOR
TOTAL	WINDOWS	DOORS	WINDOWS
0	0	0	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
70.0	70.0

INFILTRATION

SCHEDULE	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR	HEIGHT TO NEUTRAL ZONE (FT)
INFL_ACTIV	AIR-CHANGE	0.00	1.00	0.0

PEOPLE

SCHEDULE	NUMBER	AREA PER PERSON (SQFT)	PEOPLE ACTIVITY (BTU/HR)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
OCCUP	150.0	32.7	0.0	0.0	0.0

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REPORT- LV-C DETAILS OF SPACE DIN&MP BIG DELTA, AK

LIGHTING

SCHEDULE	LIGHTING TYPE	LOAD (WATTS/ SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
LIGHT_ON	REC-FLUOR-RV	0.75	0.00	1.00

INTERIOR SURFACES (U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACE	SURFACE-TYPE
	2000.00	0RESWALL	20.000	INTERIOR_C	QUICK AIR
	2000.00	0RESWALL	20.000	KITCHEN	QUICK AIR

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	WIDTH (FT)	HEIGHT (FT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
	1.0	4900.00	70.00	70.00	ROOFCON	0.075	QUICK
	1.0	1400.00	70.00	20.00	WALL_CON	0.180	QUICK
	1.0	1400.00	70.00	20.00	WALL_CON	0.180	QUICK

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	90.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00

UNDERGROUND SURFACES (U-VALUE INCLUDES INSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)
	1.0	4900.00	FLOORCON	0.10

NUMBER OF SCHEDULES 10 (NON DIMENSIONLESS SCHEDULES ARE GIVEN IN ENGLISH UNITS)

SCHEDULE FULL_OFF

THROUGH 31 12

FOR DAYS	HOUR 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SUN MON TUE WED THU FRI SAT HOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SCHEDULE OCCUP

THROUGH 5 6

FOR DAYS	HOUR 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SUN SAT HOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MON TUE WED THU FRI	0.00	0.00	0.00	0.00	0.00	0.00	0.10	1.00	1.00	1.00	0.80	0.30	1.00	1.00	0.30	0.10	0.10	0.10	0.40	0.40	0.20	0.00	0.00	0.00

THROUGH 25 8

FOR DAYS	HOUR 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SUN MON TUE WED THU FRI SAT HOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

THROUGH 31 12

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DENVER, CO 80227
REPORT- LV-G DETAILS OF SCHEDULES OCCURRING IN THE PROJECT BIG DELTA, AK

FOR DAYS	HOUR 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SUN SAT HOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MON TUE WED THU FRI	0.00	0.00	0.00	0.00	0.00	0.00	0.10	1.00	1.00	1.00	0.80	0.30	1.00	1.00	0.30	0.10	0.10	0.10	0.40	0.40	0.20	0.00	0.00	0.00

SCHEDULE LIGHT_ON

THROUGH 5 6

FOR DAYS	HOUR 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SUN SAT HOL	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
MON TUE WED THU FRI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.70	0.80	0.80	0.40	0.40	0.80	0.40	0.20	0.20	0.10	0.10	0.00	0.00	0.00	0.00	0.0

THROUGH 25 8

FOR DAYS	HOUR 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SUN MON TUE WED THU FRI SAT HOL	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04

THROUGH 31 12

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:24:10 LDL RUN 1
DENVER, CO 80227
REPORT- LV-G DETAILS OF SCHEDULES OCCURRING IN THE PROJECT BIG DELTA, AK

FOR DAYS	HOUR 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SUN SAT HOL	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
MON TUE WED THU FRI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.70	0.80	0.80	0.40	0.40	0.80	0.40	0.20	0.20	0.10	0.10	0.00	0.00	0.00	0.00	0.00

SCHEDULE DHW_CLASS

THROUGH 5 6

FOR DAYS	HOUR 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SUN SAT HOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MON TUE WED THU FRI	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.20	0.80	0.80	1.00	0.30	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

THROUGH 25 8

FOR DAYS	HOUR 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SUN MON TUE WED THU FRI SAT HOL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

THROUGH 31 12

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.20	0.80	0.80	1.00	0.30	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SCHEDULE DHW_GYM

THROUGH 5 6

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.10	0.10	0.00	0.00	0.00	0.00	0.30	0.30	0.40	0.40	0.30	0.30	0.70	0.70	0.60	0.60	1.00	1.00	0.30	0.30	0.10	0.10	0.00	0.00

THROUGH 25 8

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

THROUGH 31 12

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:24:10 LDL RUN 1
DENVER, CO 80227
REPORT- LV-G DETAILS OF SCHEDULES OCCURRING IN THE PROJECT BIG DELTA, AK

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.10	0.10	0.00	0.00	0.00	0.00	0.30	0.30	0.40	0.40	0.30	0.30	0.70	0.70	0.60	0.60	1.00	1.00	0.30	0.30	0.10	0.10	0.00	0.00

SCHEDULE DHW_CAFE

THROUGH 5 6

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.20	0.20	0.20	0.90	0.50	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

THROUGH 25 8

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

THROUGH 31 12

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:24:10 LDL RUN 1
DENVER, CO 80227
REPORT- LV-G DETAILS OF SCHEDULES OCCURRING IN THE PROJECT BIG DELTA, AK

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.20	0.20	0.20	0.90	0.50	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SCHEDULE GYM_LIGHT

THROUGH 5 6

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.80	0.40	0.80	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

THROUGH 25 8

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

THROUGH 31 12

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.80	0.40	0.80	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SCHEDULE FULL_ON

THROUGH 31 12

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

SCHEDULE INFL_ACTIV

THROUGH 5 6

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

THROUGH 25 8

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

THROUGH 31 12

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:24:10 LDL RUN 1
DENVER, CO 80227
REPORT- LV-G DETAILS OF SCHEDULES OCCURRING IN THE PROJECT BIG DELTA, AK

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

SCHEDULE GYM_INFL

THROUGH 5 6

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.25	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.15	0.15	0.15	0.15	0.15	0.15

THROUGH 25 8

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

THROUGH 31 12

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:24:10 LDL RUN 1
DENVER, CO 80227
REPORT- LV-G DETAILS OF SCHEDULES OCCURRING IN THE PROJECT BIG DELTA, AK

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.25	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.15	0.15	0.15	0.15	0.15	0.15

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:24:10 LDL RUN 1
DENVER, CO 80227
REPORT- LS-A SPACE PEAK LOADS SUMMARY BIG DELTA, AK

SPACE NAME	MULTIPLIER SPACE	MULTIPLIER FLOOR	COOLING LOAD (KBTU/HR)	TIME OF PEAK	DRY-BULB	WET-BULB	HEATING LOAD (KBTU/HR)	TIME OF PEAK	DRY-BULB	WET-BULB
INTERIOR_C	1.	1.	44.791	AUG 31 2 PM	72.F	55.F	-384.693	DEC 10 11 AM	-22.F	-22.F
EXTER_ZN_C	1.	1.	206.882	AUG 13 6 PM	73.F	60.F	-436.093	FEB 5 5 AM	-44.F	-44.F
KITCHEN	1.	1.	20.932	AUG 31 1 PM	70.F	54.F	-21.309	DEC 10 11 AM	-22.F	-22.F
GYM	1.	1.	46.007	AUG 30 1 PM	80.F	55.F	-562.438	JAN 23 3 PM	-13.F	-14.F
ADJ_TO_GYM	1.	1.	27.248	AUG 31 1 PM	70.F	54.F	-248.751	JAN 23 3 PM	-13.F	-14.F
DINEMP	1.	1.	10.120	JUL 12 5 PM	87.F	65.F	-183.747	JAN 23 3 PM	-13.F	-14.F
SUM			355.980				-1837.030			
BUILDING PEAK			272.741	AUG 31 2 PM	72.F	55.F	-1757.522	JAN 23 3 PM	-13.F	-14.F

SPACE INTERIOR_C

MULTIPLIER	1.0		FLOOR MULTIPLIER	1.0
FLOOR AREA	20342	SQFT	1890	M2
VOLUME	183078	CUFT	5185	M3

	COOLING LOAD				HEATING LOAD	
TIME	AUG 31 2PM				DEC 10 11AM	
DRY-BULB TEMP	72F	22C			-22F	-30C
WET-BULB TEMP	55F	13C			-22F	-30C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	0.000	0.000	0.000	0.000	0.000	0.000
ROOFS	35.480	10.391	0.000	0.000	-144.032	-42.183
GLASS CONDUCTION	0.000	0.000	0.000	0.000	0.000	0.000
GLASS SOLAR	0.000	0.000	0.000	0.000	0.000	0.000
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-52.297	-15.317	0.000	0.000	-95.799	-28.057
OCCUPANTS TO SPACE	29.137	8.534	28.500	8.347	0.023	0.007
LIGHT TO SPACE	32.259	9.448	0.000	0.000	2.103	0.616
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.212	0.062	0.000	0.000	-146.989	-43.049
TOTAL	44.791	13.118	28.500	8.347	-384.693	-112.667
TOTAL LOAD	73.291 KBTU/H		21.465 KW		-384.693 KBTU/H	-112.667 KW
TOTAL LOAD / AREA	3.60BTU/H.SQFT		11.358 W / M2		18.911BTU/H.SQFT	59.617 W / M2

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

SPACE EXTER_ZN_C

MULTIPLIER	1.0		FLOOR MULTIPLIER	1.0
FLOOR AREA	8829	SQFT	820	M2
VOLUME	79461	CUFT	2250	M3

	COOLING LOAD				HEATING LOAD	
TIME	AUG 13 6PM				FEB 5 5AM	SUNDAY
DRY-BULB TEMP	73F	23C			-44F	-42C
WET-BULB TEMP	60F	16C			-44F	-42C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	33.238	9.735	0.000	0.000	-129.470	-37.919
ROOFS	22.033	6.453	0.000	0.000	-75.929	-22.238
GLASS CONDUCTION	19.325	5.660	0.000	0.000	-170.843	-50.036
GLASS SOLAR	153.679	45.009	0.000	0.000	5.350	1.567
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-22.598	-6.618	0.000	0.000	-53.404	-15.641
OCCUPANTS TO SPACE	0.000	0.000	0.000	0.000	0.054	0.016
LIGHT TO SPACE	1.205	0.353	0.000	0.000	1.233	0.361
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.000	0.000	0.000	0.000	-13.083	-3.832
TOTAL	206.882	60.591	0.000	0.000	-436.093	-127.721
TOTAL LOAD	206.882 KBTU/H		60.591 KW		-436.093 KBTU/H	-127.721 KW
TOTAL LOAD / AREA	23.43BTU/H.SQFT		73.869 W / M2		49.393BTU/H.SQFT	155.711 W / M2

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

SPACE KITCHEN

MULTIPLIER 1.0 FLOOR MULTIPLIER 1.0
FLOOR AREA 910 SQFT 85 M2
VOLUME 8190 CUFT 232 M3

	COOLING LOAD				HEATING LOAD	
TIME	AUG 31 1PM				DEC 10 11AM	
DRY-BULB TEMP	70F	21C			-22F	-30C
WET-BULB TEMP	54F	12C			-22F	-30C
	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	SENSIBLE (KBTU/H)	SENSIBLE (KW)
WALLS	0.000	0.000	0.000	0.000	0.000	0.000
ROOFS	2.690	0.788	0.000	0.000	-9.908	-2.902
GLASS CONDUCTION	0.000	0.000	0.000	0.000	0.000	0.000
GLASS SOLAR	0.000	0.000	0.000	0.000	0.000	0.000
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-2.685	-0.786	0.000	0.000	-4.919	-1.441
OCCUPANTS TO SPACE	0.945	0.277	0.950	0.278	0.001	0.000
LIGHT TO SPACE	0.828	0.243	0.000	0.000	0.088	0.026
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	19.155	5.610	53.550	15.683	0.006	0.002
INFILTRATION	0.000	0.000	0.000	0.000	-6.576	-1.926
TOTAL	20.932	6.131	54.500	15.962	-21.309	-6.241
TOTAL LOAD	75.432 KBTU/H		22.092 KW		-21.309 KBTU/H	-6.241 KW
TOTAL LOAD / AREA	82.89BTU/H.SQFT		261.318 W / M2		23.416BTU/H.SQFT	73.819 W / M2

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

SPACE GYM

MULTIPLIER 1.0 FLOOR MULTIPLIER 1.0
FLOOR AREA 8150 SQFT 757 M2
VOLUME 203750 CUFT 5770 M3

	COOLING LOAD				HEATING LOAD	
TIME	AUG 30 1PM				JAN 23 3PM	
DRY-BULB TEMP	80F	27C			-13F	-25C
WET-BULB TEMP	55F	13C			-14F	-26C
	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	SENSIBLE (KBTU/H)	SENSIBLE (KW)
WALLS	3.332	0.976	0.000	0.000	-63.458	-18.585
ROOFS	5.796	1.697	0.000	0.000	-43.866	-12.847
GLASS CONDUCTION	0.000	0.000	0.000	0.000	0.000	0.000
GLASS SOLAR	0.000	0.000	0.000	0.000	0.000	0.000
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-17.736	-5.194	0.000	0.000	-38.401	-11.247
OCCUPANTS TO SPACE	24.639	7.216	60.000	17.573	11.313	3.313
LIGHT TO SPACE	7.926	2.321	0.000	0.000	2.064	0.604
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	22.050	6.458	0.000	0.000	-430.089	-125.962
TOTAL	46.007	13.474	60.000	17.573	-562.438	-164.724
TOTAL LOAD	106.007 KBTU/H		31.047 KW		-562.438 KBTU/H	-164.724 KW
TOTAL LOAD / AREA	13.01BTU/H.SQFT		41.004 W / M2		69.011BTU/H.SQFT	217.555 W / M2

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

SPACE ADJ_TO_GYM

MULTIPLIER 1.0 FLOOR MULTIPLIER 1.0
FLOOR AREA 7097 SQFT 659 M2
VOLUME 63873 CUFT 1809 M3

	COOLING LOAD				HEATING LOAD	
TIME	AUG 31 1PM				JAN 23 3PM	
DRY-BULB TEMP	70F 21C				-13F -25C	
WET-BULB TEMP	54F 12C				-14F -26C	
	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	SENSIBLE (KBTU/H)	SENSIBLE (KW)
WALLS	14.537	4.257	0.000	0.000	-42.758	-12.523
ROOFS	13.410	3.927	0.000	0.000	-43.866	-12.847
GLASS CONDUCTION	0.000	0.000	0.000	0.000	0.000	0.000
GLASS SOLAR	0.000	0.000	0.000	0.000	0.000	0.000
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-17.736	-5.194	0.000	0.000	-38.401	-11.247
OCCUPANTS TO SPACE	11.499	3.368	28.000	8.200	5.279	1.546
LIGHT TO SPACE	5.538	1.622	0.000	0.000	5.823	1.705
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	1.960	0.574	0.000	0.000
INFILTRATION	0.000	0.000	0.000	0.000	-134.827	-39.488
TOTAL	27.248	7.980	29.960	8.775	-248.751	-72.853
TOTAL LOAD	57.208 KBTU/H		16.755 KW		-248.751 KBTU/H	-72.853 KW
TOTAL LOAD / AREA	8.06BTU/H.SQFT		25.412 W / M2		35.050BTU/H.SQFT	110.495 W / M2

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

SPACE DIN&MP

MULTIPLIER 1.0 FLOOR MULTIPLIER 1.0
FLOOR AREA 4900 SQFT 455 M2
VOLUME 98000 CUFT 2775 M3

	COOLING LOAD				HEATING LOAD	
TIME	JUL 12 5PM				JAN 23 3PM	
DRY-BULB TEMP	87F 31C				-13F -25C	
WET-BULB TEMP	65F 18C				-14F -26C	
	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	SENSIBLE (KBTU/H)	SENSIBLE (KW)
WALLS	7.805	2.286	0.000	0.000	-41.989	-12.297
ROOFS	12.423	3.638	0.000	0.000	-30.994	-9.077
GLASS CONDUCTION	0.000	0.000	0.000	0.000	0.000	0.000
GLASS SOLAR	0.000	0.000	0.000	0.000	0.000	0.000
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-15.117	-4.427	0.000	0.000	-27.132	-7.946
OCCUPANTS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
LIGHT TO SPACE	0.502	0.147	0.000	0.000	5.025	1.472
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	4.507	1.320	0.000	0.000	-88.656	-25.965
TOTAL	10.120	2.964	0.000	0.000	-183.747	-53.815
TOTAL LOAD	10.120 KBTU/H		2.964 KW		-183.747 KBTU/H	-53.815 KW
TOTAL LOAD / AREA	2.07BTU/H.SQFT		6.511 W / M2		37.499BTU/H.SQFT	118.216 W / M2

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:24:10 LDL RUN 1
DENVER, CO 80227
REPORT- LS-C BUILDING PEAK LOAD COMPONENTS BIG DELTA, AK

*** BUILDING ***

FLOOR AREA 50228 SQFT 4666 SQMT
VOLUME 636352 CUFT 18021 CUMT

	COOLING LOAD				HEATING LOAD			
TIME	AUG 31 2PM				JAN 23 3PM			
DRY-BULB TEMP	72F 22C				-13F -25C			
WET-BULB TEMP	55F 13C				-14F -26C			
	SENSIBLE		LATENT		SENSIBLE			
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)		
WALLS	26.775	7.842	0.000	0.000	-245.905	-72.019		
ROOFS	85.800	25.129	0.000	0.000	-312.866	-91.631		
GLASS CONDUCTION	-0.588	-0.172	0.000	0.000	-141.328	-41.391		
GLASS SOLAR	99.347	29.096	0.000	0.000	18.996	5.563		
DOOR	0.000	0.000	0.000	0.000	0.000	0.000		
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000		
UNDERGROUND SURFACES	-125.583	-36.780	0.000	0.000	-271.906	-79.635		
OCCUPANTS TO SPACE	96.407	28.235	145.950	42.745	43.046	12.607		
LIGHT TO SPACE	77.390	22.666	0.000	0.000	46.716	13.682		
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000		
PROCESS TO SPACE	12.041	3.527	32.160	9.419	4.215	1.234		
INFILTRATION	1.152	0.337	0.000	0.000	-898.490	-263.145		
TOTAL	272.741	79.879	178.110	52.164	-1757.522	-514.734		
TOTAL LOAD	450.851 KBTU/H		132.043	KW	-1757.522 KBTU/H	-514.734	KW	
TOTAL LOAD / AREA	8.98BTU/H.SQFT		28.297	W /SQMT	34.991BTU/H.SQFT	110.308	W /SQMT	

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:24:10 LDL RUN 1
DENVER, CO 80227
REPORT- LS-D BUILDING MONTHLY LOADS SUMMARY BIG DELTA, AK

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELECTRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.11277	27	13	2.F	1.F	7.863	-771.729	23	15	-13.F	-14.F	-1757.523	4391.	29.372
FEB	0.14114	28	13	38.F	32.F	10.557	-632.603	5	23	-9.F	-9.F	-1425.285	3972.	29.372
MAR	0.35051	25	16	37.F	31.F	39.136	-578.262	5	9	-16.F	-17.F	-1293.416	4717.	29.372
APR	1.57152	29	14	47.F	34.F	75.804	-405.140	19	6	-4.F	-6.F	-1010.668	4197.	29.372
MAY	16.66534	26	16	60.F	49.F	148.037	-241.652	14	4	29.F	26.F	-677.164	4554.	29.372
JUN	27.96722	5	13	75.F	55.F	209.919	-160.630	14	11	42.F	41.F	-470.972	1429.	29.372
JUL	29.37049	12	16	87.F	65.F	245.944	-135.042	28	4	40.F	37.F	-416.743	971.	1.306
AUG	23.81013	31	13	72.F	55.F	272.741	-141.883	21	5	37.F	36.F	-399.357	1623.	29.372
SEP	6.98257	1	16	65.F	54.F	187.243	-215.896	21	5	18.F	16.F	-557.169	4197.	29.372
OCT	0.39809	2	12	40.F	36.F	14.562	-393.496	29	5	-5.F	-6.F	-781.565	4391.	29.372
NOV	0.24663	15	13	25.F	23.F	11.780	-564.183	23	15	1.F	0.F	-1077.247	4197.	29.372
DEC	0.13018	28	13	9.F	7.F	8.737	-725.411	10	11	-22.F	-22.F	-1514.177	4229.	29.372
TOTAL	107.747						-4965.928						42870.	
MAX						272.741						-1757.523		29.372

MMDDHH	BUILDING SENSIBLE HTG LOAD BTU/HR ----(1)	BUILDING LATENT HTG LOAD BTU/HR ----(2)	GLOBAL DRY BULB TEMP F ----(4)	GLOBAL GROUND ABS TEMP R ----(2)	GLOBAL SNOW FLAG ----(7)
MONTHLY SUMMARY (JAN)					
MN	-1757523.	0.	-42.0	474.6	0.
MX	-611893.	178110.	18.0	474.6	1.
SM	-771729600.	26385040.	-3378.0	353122.9	100.
AV	-1037271.	35464.	-4.5	474.6	0.
MONTHLY SUMMARY (FEB)					
MN	-1425285.	0.	-44.0	469.6	0.
MX	-375395.	178110.	40.0	469.6	1.
SM	-632603264.	23673360.	1340.0	315544.8	10.
AV	-941374.	35228.	2.0	469.6	0.
MONTHLY SUMMARY (MAR)					
MN	-1293416.	0.	-53.0	469.2	0.
MX	-217540.	178110.	42.0	469.2	1.
SM	-578261504.	28484470.	6894.0	349051.3	48.
AV	-777233.	38286.	9.3	469.2	0.
MONTHLY SUMMARY (APR)					
MN	-1010668.	0.	-13.0	471.6	0.
MX	-142705.	162570.	52.0	471.6	1.
SM	-405140736.	24380300.	19827.0	339522.8	68.
AV	-562695.	33862.	27.5	471.6	0.
MONTHLY SUMMARY (MAY)					
MN	-677164.	0.	25.0	481.2	0.
MX	-21411.	162570.	70.0	481.2	1.
SM	-241652144.	22947736.	35459.0	358021.8	2.
AV	-324801.	30844.	47.7	481.2	0.
MONTHLY SUMMARY (JUN)					
MN	-470972.	0.	41.0	490.8	0.
MX	0.	124520.	82.0	490.8	0.
SM	-160629744.	1897805.	41425.0	353390.3	0.
AV	-223097.	2636.	57.5	490.8	0.
MONTHLY SUMMARY (JUL)					
MN	-416743.	0.	38.0	499.1	0.
MX	0.	0.	87.0	499.1	0.
SM	-135042240.	0.	44355.0	371367.1	0.
AV	-181508.	0.	59.6	499.1	0.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:58:37 LDL RUN 1
DENVER, CO 80227
LDS_RPT_1 = HOURLY-REPORT BIG DELTA, AK

	BUILDING SENSIBLE HTG LOAD BTU/HR ----(1)	BUILDING LATENT HTG LOAD BTU/HR ----(2)	GLOBAL DRY BULB TEMP F ----(4)	GLOBAL GROUND ABS TEMP R ----(2)	GLOBAL SNOW FLAG ----(7)
MONTHLY SUMMARY (AUG)					
MN	-399357.	0.	37.0	504.4	0.
MX	0.	153920.	82.0	504.4	0.
SM	-141883408.	2438905.	41588.0	375292.8	0.
AV	-190704.	3278.	55.9	504.4	0.
MONTHLY SUMMARY (SEP)					
MN	-557169.	0.	18.0	504.9	0.
MX	-4977.	162570.	68.0	504.9	1.
SM	-215896464.	22228098.	30923.0	363509.2	15.
AV	-299856.	30872.	42.9	504.9	0.
MONTHLY SUMMARY (OCT)					
MN	-781565.	0.	-7.0	500.6	0.
MX	-198637.	162570.	45.0	500.6	1.
SM	-393495904.	25859190.	18356.0	372433.1	38.
AV	-528892.	34757.	24.7	500.6	0.
MONTHLY SUMMARY (NOV)					
MN	-1077247.	0.	-30.0	492.5	0.
MX	-394072.	162570.	35.0	492.5	1.
SM	-564183360.	24660800.	5216.0	354575.3	39.
AV	-783588.	34251.	7.2	492.5	0.
MONTHLY SUMMARY (DEC)					
MN	-1514177.	0.	-47.0	483.2	0.
MX	-616505.	178110.	20.0	483.2	1.
SM	-725411136.	24906400.	-4934.0	359465.4	28.
AV	-975015.	33476.	-6.6	483.2	0.
YEARLY SUMMARY					
MN	-1757523.	0.	-53.0	469.2	0.
MX	0.	178110.	87.0	504.9	1.
SM	-4965829472.	227862096.	237071.0	4265296.5	348.
AV	-566887.	26012.	27.1	486.9	0.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:58:37 SDL RUN 1
DENVER, CO 80227
REPORT- SS-D PLANT MONTHLY LOADS SUMMARY FOR DEFAULT-PLANT BIG DELTA, AK

	COOLING					HEATING					ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELECTRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-877.518	23	12	-14.F	-15.F	-2261.917	19455.	51.011
FEB	0.00000					0.000	-709.159	3	12	-29.F	-29.F	-2082.823	17577.	51.011
MAR	0.00000					0.000	-636.998	3	12	-20.F	-21.F	-1926.137	19786.	51.011
APR	0.00000					0.000	-430.280	19	11	7.F	3.F	-1538.247	18774.	51.011
MAY	0.00000					0.000	-205.947	14	7	33.F	29.F	-827.093	19621.	51.011
JUN	0.00000					0.000	-80.255	3	8	52.F	48.F	-325.045	3857.	51.011
JUL	0.00000					0.000	-65.168	27	6	43.F	41.F	-260.948	971.	1.306
AUG	0.00000					0.000	-82.051	26	2	47.F	44.F	-977.032	4538.	51.011
SEP	0.00000					0.000	-195.052	22	7	22.F	19.F	-674.449	18774.	51.011
OCT	0.00000					0.000	-425.595	25	12	12.F	11.F	-1248.754	19455.	51.011
NOV	0.00000					0.000	-635.392	23	15	1.F	0.F	-1579.704	18774.	51.011
DEC	0.00000					0.000	-829.013	11	12	-20.F	-21.F	-2297.867	19289.	51.011
TOTAL	0.000						-5172.427						180867.	
MAX						0.000						-2297.867		51.011

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:58:37 SDL RUN 1
DENVER, CO 80227
REPORT- SS-O TEMPERATURE SCATTER PLOT MPHVU FOR DIN&MP BIG DELTA, AK

TOTAL HOURS AT TEMPERATURE LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
ABOVE 85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81-85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71-75	230	230	224	221	220	217	150	154	156	159	158	155	163	170	169	214	222	230	226	228	230	228	230	228	4812
66-70	54	54	60	63	64	67	134	130	128	125	126	129	121	114	115	70	62	54	58	56	54	56	54	56	2004
61-65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BELOW 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 9:58:37 PDL RUN 1
DENVER, CO 80227
REPORT- PS-A PLANT ENERGY UTILIZATION SUMMARY BIG DELTA, AK

	SITE ENERGY												SOURCE
	2	3	4	5	6	7	8	9	10	11	12	13	14
MONTH	TOTAL HEAT LOAD	TOTAL COOLING LOAD	TOTAL ELECTR LOAD	RCVRED ENERGY	WASTED RCVRABL ENERGY	FUEL INPUT COOLING	ELEC INPUT COOLING	FUEL INPUT HEATING	ELEC INPUT HEATING	FUEL INPUT ELECT	TOTAL FUEL INPUT	TOTAL SITE ENERGY	TOTAL SOURCE ENERGY
JAN	911.7	0.0	72.8 21.3E	0.0	0.0	0.0	0.0 0.0E	0.0	6.3 1.9E	0.0	0.0	984.4	1738.0
FEB	740.0	0.0	65.7 19.3E	0.0	0.0	0.0	0.0 0.0E	0.0	5.7 1.7E	0.0	0.0	805.8	1430.8
MAR	673.3	0.0	73.9 21.6E	0.0	0.0	0.0	0.0 0.0E	0.0	6.3 1.9E	0.0	0.0	747.2	1344.1
APR	463.0	0.0	70.2 20.6E	0.0	0.0	0.0	0.0 0.0E	0.0	6.1 1.8E	0.0	0.0	533.2	982.6
MAY	241.2	0.0	73.3 21.5E	0.0	0.0	0.0	0.0 0.0E	0.0	6.3 1.9E	0.0	0.0	314.5	622.2
JUN	93.8	0.0	18.9 5.5E	0.0	0.0	0.0	0.0 0.0E	0.0	5.8 1.7E	0.0	0.0	112.8	213.2
JUL	75.7	0.0	9.2 2.7E	0.0	0.0	0.0	0.0 0.0E	0.0	5.8 1.7E	0.0	0.0	84.8	153.6
AUG	97.2	0.0	21.5 6.3E	0.0	0.0	0.0	0.0 0.0E	0.0	6.0 1.8E	0.0	0.0	118.7	226.5
SEP	227.6	0.0	70.2 20.6E	0.0	0.0	0.0	0.0 0.0E	0.0	6.1 1.8E	0.0	0.0	297.8	590.1
OCT	459.8	0.0	72.8 21.3E	0.0	0.0	0.0	0.0 0.0E	0.0	6.3 1.9E	0.0	0.0	532.5	984.8
NOV	668.1	0.0	70.2 20.6E	0.0	0.0	0.0	0.0 0.0E	0.0	6.1 1.8E	0.0	0.0	738.3	1324.4
DEC	862.1	0.0	72.2 21.1E	0.0	0.0	0.0	0.0 0.0E	0.0	6.3 1.9E	0.0	0.0	934.3	1653.6
	5513.5	0.0	690.9 202.4E	0.0	0.0	0.0	0.0 0.0E	0.0	73.3 21.5E	0.0	0.0	6204.4	11263.9

NOTE-- ALL ENTRIES ARE IN MBTU EXCEPT
ENTRIES FOLLOWED BY E ARE IN MWH (THOUSANDS OF KWH)

#1402.003
FT GREELY
11.23.95

DOE-2.1D

BUILDING ENERGY ANALYSIS PROGRAM

DEVELOPED BY
LAWRENCE BERKELEY LABORATORY/UNIVERSITY OF CALIFORNIA
AND
James J. Hirsch/HIRSCH & ASSOCIATES/(805) 482-5515

FT GREELY SCHOOL
SPACES AT 4SF

WITH MAJOR SUPPORT FROM
UNITED STATES DEPARTMENT OF ENERGY
ASSISTANT SECRETARY FOR CONSERVATION AND RENEWABLE ENERGY
OFFICE OF BUILDINGS AND COMMUNITY SYSTEMS
BUILDING SYSTEMS DIVISION

LBL RELEASE DEC 1990 version : JJHirsch PC 2.1D-017
Elite Software PC DOE-2.1D released in April 1993.

PERIOD OF STUDY

STARTING DATE	ENDING DATE	NUMBER OF DAYS
1 JAN 1995	31 DEC 1995	365

SITE CHARACTERISTIC DATA

STATION NAME	LATITUDE (DEG)	LONGITUDE (DEG)	ALTITUDE (FT)	TIME ZONE		BUILDING AZIMUTH (DEG)
BIG DELTA, AK	64.5	145.6	0.	9	AST	0.0

NUMBER OF SPACES 6 EXTERIOR 6 INTERIOR 0

SPACE	SPACE MULT	SPACE TYPE	AZIMUTH	LIGHTING (WATT / SQFT)	PEOPLE	EQUIP (WATT / SQFT)	INFILTRATION METHOD	AIR CHANGES PER HOUR	AREA (SQFT)	VOLUME (CUFT)
INTERIOR_C	1.0	EXT	0.0	0.75	150.0	0.00	AIR-CHANGE	1.00	20342.00	183078.00
EXTER_ZN_C	1.0	EXT	0.0	1.00	150.0	0.00	AIR-CHANGE	1.00	8829.00	79461.00
KITCHEN	1.0	EXT	0.0	0.70	5.0	0.00	AIR-CHANGE	1.00	910.00	8190.00
GYM	1.0	EXT	0.0	0.50	75.0	0.00	AIR-CHANGE	1.00	8150.00	203750.00
ADJ_TO_GYM	1.0	EXT	0.0	0.60	35.0	0.00	AIR-CHANGE	1.00	7097.00	63873.00
DINRMP	1.0	EXT	0.0	0.75	150.0	0.00	AIR-CHANGE	1.00	4900.00	98000.00
BUILDING TOTALS					565.0				50228.00	636352.00

DATA FOR SPACE INTERIOR_C

LOCATION OF ORIGIN IN BUILDING COORDINATES

XB (FT)	YB (FT)	ZB (FT)	SPACE AZIMUTH (DEG)	SPACE MULTIPLIER	HEIGHT (FT)	AREA (SQFT)	VOLUME (CUFT)
0.00	0.00	0.00	0.00	1.0	9.00	20342.00	183078.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
4	1	2	1	NO	NO

NUMBER OF SUBSURFACES

TOTAL	EXTERIOR WINDOWS	DOORS	INTERIOR WINDOWS
0	0	0	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
70.0	45.0

INFILTRATION

SCHEDULE	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR	HEIGHT TO NEUTRAL ZONE (FT)
INFL_ACTIV	AIR-CHANGE	0.00	1.00	0.0

PEOPLE

SCHEDULE	NUMBER	AREA PER PERSON (SQFT)	PEOPLE ACTIVITY (BTU/HR)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
FULL_OFF	150.0	135.6	0.0	230.0	190.0

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REPORT- LV-C DETAILS OF SPACE INTERIOR_C BIG DELTA, AK

LIGHTING

SCHEDULE	LIGHTING TYPE	LOAD (WATTS/ SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
FULL_OFF	REC-FLUOR-RV	0.75	0.00	1.00

INTERIOR SURFACES (U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACE	SURFACE-TYPE
	10000.00	0RESWALL	20.000	EXTER_ZN_C	QUICK AIR
	2000.00	0RESWALL	20.000	DIN&MP	QUICK AIR

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	WIDTH (FT)	HEIGHT (FT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
	1.0	20449.00	143.00	143.00	ROOFCON	0.075	QUICK

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00

UNDERGROUND SURFACES (U-VALUE INCLUDES INSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)
	1.0	20449.00	FLOORCON	0.10

DATA FOR SPACE EXTER_ZN_C

LOCATION OF ORIGIN IN BUILDING COORDINATES

XB (FT)	YB (FT)	ZB (FT)
0.00	0.00	0.00

SPACE AZIMUTH (DEG)	SPACE MULTIPLIER	HEIGHT (FT)	AREA (SQFT)	VOLUME (CUFT)
0.00	1.0	9.00	8829.00	79461.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
7	5	1	1	NO	NO

NUMBER OF SUBSURFACES

TOTAL	EXTERIOR WINDOWS	DOORS	INTERIOR WINDOWS
4	4	0	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
70.0	45.0

INFILTRATION

	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR	HEIGHT TO NEUTRAL ZONE (FT)
SCHEDULE				
INFL_ACTIV	AIR-CHANGE	0.00	1.00	0.0

PEOPLE

	NUMBER	AREA PER PERSON (SQFT)	PEOPLE ACTIVITY (BTU/HR)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
SCHEDULE					
FULL_OFF	150.0	58.9	0.0	230.0	190.0

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DENVER, CO 80227
REPORT- LV-C DETAILS OF SPACE EXTER_ZN_C BIG DELTA, AK

LIGHTING

	LIGHTING TYPE	LOAD (WATTS/ SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
SCHEDULE				
FULL_OFF	REC-FLUOR-RV	1.00	0.00	1.00

OTHER EQUIPMENT

	SOURCE TYPE	LOAD (BTU/HR)	FRACTION OF LOAD TO SPACE SENSIBLE	LATENT
SCHEDULE				
DHW_CLASS	HOT-WATER	45000.0	0.00	0.10

INTERIOR SURFACES (U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACE	SURFACE-TYPE
	10000.00	0RESWALL	20.000	INTERIOR_C	QUICK AIR

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	WIDTH (FT)	HEIGHT (FT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
	1.0	8836.00	94.00	94.00	ROOFCON	0.075	QUICK
	1.0	2304.00	256.00	9.00	WALL_CON	0.180	QUICK
	1.0	2439.00	271.00	9.00	WALL_CON	0.180	QUICK
	1.0	3294.00	366.00	9.00	WALL_CON	0.180	QUICK
	1.0	1629.00	181.00	9.00	WALL_CON	0.180	QUICK

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
	90.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	180.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	270.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00

UNDERGROUND SURFACES (U-VALUE INCLUDES INSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)
	1.0	8836.00	FLOORCON	0.10

EXTERIOR WINDOWS

WINDOW	MULTIPLIER	AREA (SQFT)	SHADING COEFF	NUMBER OF PANES	GLASS TYPE INDEX	SET-BACK (FT)	WIDTH (FT)	HEIGHT (FT)	SKY FORM FACTOR	GROUND FORM FACTOR
	43.0	21.00	1.00	1	5	0.00	7.00	3.00		
	25.0	21.00	1.00	1	5	0.00	7.00	3.00		
	57.0	21.00	1.00	1	5	0.00	7.00	3.00		
	23.0	21.00	1.00	1	5	0.00	7.00	3.00		

WINDOW	LOCATED IN SURFACE	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SURFACE COORDINATES X (FT)	Y (FT)
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00	0.00	0.00

DATA FOR SPACE KITCHEN

LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	SPACE AZIMUTH (DEG)	SPACE MULTIPLIER	HEIGHT (FT)	AREA (SQFT)	VOLUME (CUFT)
0.00	0.00	0.00	0.00	1.0	9.00	910.00	8190.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
4	2	1	1	NO	NO

NUMBER OF SUBSURFACES

TOTAL	EXTERIOR WINDOWS	DOORS	INTERIOR WINDOWS
0	0	0	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
70.0	45.0

INFILTRATION

SCHEDULE	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR	HEIGHT TO NEUTRAL ZONE (FT)
INFL_ACTIV	AIR-CHANGE	0.00	1.00	0.0

PEOPLE

SCHEDULE	NUMBER	AREA PER PERSON (SQFT)	PEOPLE ACTIVITY (BTU/HR)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
FULL_OFF	5.0	182.0	0.0	230.0	190.0

LIGHTING

SCHEDULE	LIGHTING TYPE	LOAD (WATTS/SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
FULL_OFF	REC-FLUOR-RV	0.70	0.00	1.00

OTHER EQUIPMENT

SCHEDULE	SOURCE TYPE	LOAD (BTU/HR)	FRACTION OF LOAD TO SPACE SENSIBLE	LATENT
DHW_CAFE	HOT-WATER	297500.0	0.10	0.20

INTERIOR SURFACES (U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACE	SURFACE-TYPE
	2000.00	0RESWALL	20.000	DIN&MP	QUICK AIR

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	WIDTH (FT)	HEIGHT (FT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
	1.0	1050.00	15.00	70.00	ROOFCON	0.075	QUICK
	1.0	150.00	15.00	10.00	WALL_CON	0.180	QUICK

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00

UNDERGROUND SURFACES (U-VALUE INCLUDES INSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)
	1.0	1050.00	FLOORCON	0.10

DATA FOR SPACE GYM

LOCATION OF ORIGIN IN BUILDING COORDINATES

XB (FT)	YB (FT)	ZB (FT)	SPACE AZIMUTH (DEG)	SPACE MULTIPLIER	HEIGHT (FT)	AREA (SQFT)	VOLUME (CUFT)
0.00	0.00	0.00	0.00	1.0	25.00	8150.00	203750.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
6	4	1	1	NO	NO

NUMBER OF SUBSURFACES

EXTERIOR TOTAL	EXTERIOR WINDOWS	EXTERIOR DOORS	INTERIOR WINDOWS
0	0	0	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
70.0	45.0

INFILTRATION

SCHEDULE	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR	HEIGHT TO NEUTRAL ZONE (FT)
GYM_INFL	AIR-CHANGE	0.00	1.00	0.0

PEOPLE

SCHEDULE	NUMBER	AREA PER PERSON (SQFT)	PEOPLE ACTIVITY (BTU/HR)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
FULL_OFF	75.0	108.7	0.0	400.0	800.0

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LIGHTING

SCHEDULE	LIGHTING TYPE	LOAD (WATTS/ SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
FULL_OFF	REC-FLUOR-RV	0.50	0.00	1.00

INTERIOR SURFACES (U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACE	SURFACE-TYPE
	2000.00	0RESWALL	20.000	ADJ_TO_GYM	QUICK AIR

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	WIDTH (FT)	HEIGHT (FT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
	1.0	6935.00	73.00	95.00	ROOFCON	0.075	QUICK
	1.0	2500.00	100.00	25.00	WALL_CON	0.180	QUICK
	1.0	100.00	5.00	20.00	WALL_CON	0.180	QUICK
	1.0	1640.00	82.00	20.00	WALL_CON	0.180	QUICK

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	180.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	270.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00

UNDERGROUND SURFACES (U-VALUE INCLUDES INSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)
	1.0	6935.00	FLOORCON	0.10

DATA FOR SPACE ADJ_TO_GYM

LOCATION OF ORIGIN IN BUILDING COORDINATES

XB (FT)	YB (FT)	ZB (FT)	SPACE AZIMUTH (DEG)	SPACE MULTIPLIER	HEIGHT (FT)	AREA (SQFT)	VOLUME (CUFT)
0.00	0.00	0.00	0.00	1.0	9.00	7097.00	63873.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
7	5	1	1	NO	NO

NUMBER OF SUBSURFACES

TOTAL	EXTERIOR WINDOWS	EXTERIOR DOORS	INTERIOR WINDOWS
0	0	0	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
70.0	45.0

INFILTRATION

SCHEDULE	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR	HEIGHT TO NEUTRAL ZONE (FT)
GYM_INFL	AIR-CHANGE	0.00	1.00	0.0

PEOPLE

SCHEDULE	NUMBER	AREA PER PERSON (SQFT)	PEOPLE ACTIVITY (BTU/HR)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
FULL_OFF	35.0	202.8	0.0	400.0	800.0

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REPORT- LV-C DETAILS OF SPACE ADJ_TO_GYM BIG DELTA, AK

LIGHTING

SCHEDULE	LIGHTING TYPE	LOAD (WATTS/ SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
FULL_OFF	REC-FLUOR-RV	0.60	0.00	1.00

OTHER EQUIPMENT

SCHEDULE	SOURCE TYPE	LOAD (BTU/HR)	FRACTION OF LOAD TO SPACE SENSIBLE	FRACTION OF LOAD TO SPACE LATENT
DHW_GYM	HOT-WATER	28000.0	0.00	0.10

INTERIOR SURFACES (U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACE	SURFACE-TYPE
	2000.00	0RESWALL	20.000	GYM	QUICK AIR

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	WIDTH (FT)	HEIGHT (FT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
	1.0	6935.00	73.00	95.00	ROOFCON	0.075	QUICK
	1.0	522.00	58.00	9.00	WALL_CON	0.180	QUICK
	1.0	868.50	96.50	9.00	WALL_CON	0.180	QUICK
	1.0	1350.00	150.00	9.00	WALL_CON	0.180	QUICK
	1.0	135.00	15.00	9.00	WALL_CON	0.180	QUICK

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	90.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	180.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	270.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00

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REPORT- LV-C DETAILS OF SPACE ADJ_TO_GYM BIG DELTA, AK

UNDERGROUND SURFACES (U-VALUE INCLUDES INSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)
	1.0	6935.00	FLOORCON	0.10

DATA FOR SPACE DIN&MP

LOCATION OF ORIGIN IN BUILDING COORDINATES

XB (FT)	YB (FT)	ZB (FT)	SPACE AZIMUTH (DEG)	SPACE MULTIPLIER	HEIGHT (FT)	AREA (SQFT)	VOLUME (CUFT)
0.00	0.00	0.00	0.00	1.0	20.00	4900.00	98000.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
6	3	2	1	NO	NO

NUMBER OF SUBSURFACES

EXTERIOR			INTERIOR
TOTAL	WINDOWS	DOORS	WINDOWS
0	0	0	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
70.0	45.0

INFILTRATION

SCHEDULE	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR	HEIGHT TO NEUTRAL ZONE (FT)
INFL_ACTIV	AIR-CHANGE	0.00	1.00	0.0

PEOPLE

SCHEDULE	NUMBER	AREA PER PERSON (SQFT)	PEOPLE ACTIVITY (BTU/HR)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
FULL_OFF	150.0	32.7	0.0	0.0	0.0

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DENVER, CO 80227
REPORT- LV-C DETAILS OF SPACE DIN&MP BIG DELTA, AK

LIGHTING

SCHEDULE	LIGHTING TYPE	LOAD (WATTS/ SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
FULL_OFF	REC-FLUOR-RV	0.75	0.00	1.00

INTERIOR SURFACES (U-VALUE INCLUDES BOTH AIR FILMS)

SURFACE	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	ADJACENT SPACE	SURFACE-TYPE
	2000.00	0RESWALL	20.000	INTERIOR_C	QUICK AIR
	2000.00	0RESWALL	20.000	KITCHEN	QUICK AIR

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	WIDTH (FT)	HEIGHT (FT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
	1.0	4900.00	70.00	70.00	ROOFCON	0.075	QUICK
	1.0	1400.00	70.00	20.00	WALL_CON	0.180	QUICK
	1.0	1400.00	70.00	20.00	WALL_CON	0.180	QUICK

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00
	0.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
	90.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00

UNDERGROUND SURFACES (U-VALUE INCLUDES INSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)
	1.0	4900.00	FLOORCON	0.10

NUMBER OF SCHEDULES 10 (NON DIMENSIONLESS SCHEDULES ARE GIVEN IN ENGLISH UNITS)

SCHEDULE FULL_OFF

THROUGH 31 12

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SCHEDULE OCCUP

THROUGH 5 6

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.10	1.00	1.00	1.00	0.80	0.30	1.00	1.00	0.30	0.10	0.10	0.10	0.40	0.40	0.20	0.00	0.00	0.00

THROUGH 25 8

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

THROUGH 31 12

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 LDL RUN 1
DENVER, CO 80227
REPORT- LV-G DETAILS OF SCHEDULES OCCURRING IN THE PROJECT BIG DELTA, AK

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.10	1.00	1.00	1.00	0.80	0.30	1.00	1.00	0.30	0.10	0.10	0.10	0.40	0.40	0.20	0.00	0.00	0.00

SCHEDULE LIGHT_ON

THROUGH 5 6

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.70	0.80	0.80	0.40	0.40	0.80	0.40	0.20	0.20	0.10	0.10	0.00	0.00	0.00	0.00	0

THROUGH 25 8

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04

THROUGH 31 12

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 LDL RUN 1
DENVER, CO 80227
REPORT- LV-G DETAILS OF SCHEDULES OCCURRING IN THE PROJECT BIG DELTA, AK

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.70	0.80	0.80	0.40	0.40	0.80	0.40	0.20	0.20	0.10	0.10	0.00	0.00	0.00	0.00	0.00

SCHEDULE DHW_CLASS

THROUGH 5 6

FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.20	0.80	0.80	1.00	0.30	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

THROUGH 25 8

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

THROUGH 31 12

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        FOR DAYS  SUN SAT HOL
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

        FOR DAYS  MON TUE WED THU FRI
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.00 0.00 0.00 0.00 0.00 0.00 0.10 0.20 0.20 0.80 0.80 1.00 0.30 0.10 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

    SCHEDULE  DHW_GYM

        THROUGH  5  6

        FOR DAYS  SUN SAT HOL
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

        FOR DAYS  MON TUE WED THU FRI
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.10 0.10 0.00 0.00 0.00 0.00 0.30 0.30 0.40 0.40 0.30 0.30 0.70 0.70 0.60 0.60 1.00 1.00 0.30 0.30 0.10 0.10 0.00 0.00

        THROUGH 25  8

        FOR DAYS  SUN MON TUE WED THU FRI SAT HOL
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

        THROUGH 31 12
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 LDL RUN 1
DENVER, CO 80227
REPORT- LV-G DETAILS OF SCHEDULES OCCURRING IN THE PROJECT BIG DELTA, AK

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        FOR DAYS  SUN SAT HOL
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

        FOR DAYS  MON TUE WED THU FRI
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.10 0.10 0.00 0.00 0.00 0.00 0.30 0.30 0.40 0.40 0.30 0.30 0.70 0.70 0.60 0.60 1.00 1.00 0.30 0.30 0.10 0.10 0.00 0.00

    SCHEDULE  DHW_CAFE

        THROUGH  5  6

        FOR DAYS  SUN SAT HOL
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

        FOR DAYS  MON TUE WED THU FRI
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.10 0.10 0.20 0.20 0.20 0.90 0.50 0.10 0.10 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

        THROUGH 25  8

        FOR DAYS  SUN MON TUE WED THU FRI SAT HOL
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

        THROUGH 31 12
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EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 LDL RUN 1
DENVER, CO 80227
REPORT- LV-G DETAILS OF SCHEDULES OCCURRING IN THE PROJECT BIG DELTA, AK

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        FOR DAYS  SUN SAT HOL
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

        FOR DAYS  MON TUE WED THU FRI
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.10 0.10 0.20 0.20 0.20 0.90 0.50 0.10 0.10 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

    SCHEDULE  GYM_LIGHT

        THROUGH  5  6

        FOR DAYS  SUN SAT HOL
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

        FOR DAYS  MON TUE WED THU FRI
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.80 0.80 0.40 0.80 0.80 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

        THROUGH 25  8

        FOR DAYS  SUN MON TUE WED THU FRI SAT HOL
HOUR  1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   17   18   19   20   21   22   23   24
    0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

        THROUGH 31 12
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FOR DAYS SUN SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.80	0.40	0.80	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

SCHEDULE FULL_ON

THROUGH 31 12

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

SCHEDULE INFL_ACTIV

THROUGH 5 6

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

THROUGH 25 8

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

THROUGH 31 12

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 LDL RUN 1
DENVER, CO 80227
REPORT- LV-G DETAILS OF SCHEDULES OCCURRING IN THE PROJECT BIG DELTA, AK

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

SCHEDULE GYM_INFL

THROUGH 5 6

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

THROUGH 25 8

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

THROUGH 31 12

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 LDL RUN 1
DENVER, CO 80227
REPORT- LS-A SPACE PEAK LOADS SUMMARY BIG DELTA, AK

SPACE NAME	MULTIPLIER SPACE	MULTIPLIER FLOOR	COOLING LOAD (KBTU/HR)	TIME OF PEAK	DRY-BULB	WET-BULB	HEATING LOAD (KBTU/HR)	TIME OF PEAK	DRY-BULB	WET-BULB
INTERIOR_C	1.	1.	97.599	AUG 14 3 PM	82.F	63.F	-269.051	JAN 23 3 PM	-13.F	-14.F
EXTER_ZN_C	1.	1.	307.936	JUL 12 5 PM	87.F	65.F	-331.204	FEB 5 5 AM	-44.F	-44.F
KITCHEN	1.	1.	24.303	AUG 31 1 PM	70.F	54.F	-14.365	DEC 10 11 AM	-22.F	-22.F
GYM	1.	1.	84.385	AUG 24 5 PM	78.F	66.F	-225.416	JAN 23 3 PM	-13.F	-14.F
ADJ_TO_GYM	1.	1.	59.949	AUG 14 3 PM	82.F	63.F	-124.013	FEB 5 5 AM	-44.F	-44.F
DIN&MP	1.	1.	48.536	AUG 24 5 PM	78.F	66.F	-128.236	JAN 23 3 PM	-13.F	-14.F
SUM			622.707				-1092.286			
BUILDING PEAK			588.090	JUL 12 5 PM	87.F	65.F	-1050.699	DEC 10 11 AM	-22.F	-22.F

SPACE INTERIOR_C

MULTIPLIER	1.0		FLOOR MULTIPLIER	1.0
FLOOR AREA	20342	SQFT	1890	M2
VOLUME	183078	CUFT	5185	M3

	COOLING LOAD				HEATING LOAD	
TIME	AUG 14	3PM			JAN 23	3PM
DRY-BULB TEMP	82F	28C			-13F	-25C
WET-BULB TEMP	63F	17C			-14F	-26C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	0.000	0.000	0.000	0.000	0.000	0.000
ROOFS	94.833	27.774	0.000	0.000	-91.206	-26.712
GLASS CONDUCTION	0.000	0.000	0.000	0.000	0.000	0.000
GLASS SOLAR	0.000	0.000	0.000	0.000	0.000	0.000
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-1.175	-0.344	0.000	0.000	-62.109	-18.190
OCCUPANTS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
LIGHT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	3.941	1.154	0.000	0.000	-115.736	-33.896
TOTAL	97.599	28.584	0.000	0.000	-269.051	-78.798
TOTAL LOAD	97.599 KBTU/H		28.584 KW		-269.051 KBTU/H	-78.798 KW
TOTAL LOAD / AREA	4.80BTU/H.SQFT		15.125 W / M2		13.226BTU/H.SQFT	41.696 W / M2

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* *
* NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* ---- LOADS *
* 2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *
* *
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SPACE EXTER_ZN_C

MULTIPLIER	1.0		FLOOR MULTIPLIER	1.0
FLOOR AREA	8829	SQFT	820	M2
VOLUME	79461	CUFT	2250	M3

	COOLING LOAD				HEATING LOAD	
TIME	JUL 12	5PM			FEB 5	5AM
DRY-BULB TEMP	87F	31C			-44F	-42C
WET-BULB TEMP	65F	18C			-44F	-42C
	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALLS	57.678	16.892	0.000	0.000	-101.339	-29.680
ROOFS	38.672	11.326	0.000	0.000	-59.694	-17.483
GLASS CONDUCTION	65.351	19.140	0.000	0.000	-133.994	-39.243
GLASS SOLAR	144.633	42.359	0.000	0.000	5.350	1.567
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-5.170	-1.514	0.000	0.000	-31.314	-9.171
OCCUPANTS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
LIGHT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	6.772	1.983	0.000	0.000	-10.214	-2.991
TOTAL	307.936	90.187	0.000	0.000	-331.204	-97.002
TOTAL LOAD	307.936 KBTU/H		90.187 KW		-331.204 KBTU/H	-97.002 KW
TOTAL LOAD / AREA	34.88BTU/H.SQFT		109.952 W / M2		37.513BTU/H.SQFT	118.260 W / M2

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* *
* NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR *
* ---- LOADS *
* 2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION *
* IN CONSIDERATION *
* *
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SPACE KITCHEN

MULTIPLIER	1.0		FLOOR MULTIPLIER	1.0
FLOOR AREA	910	SQFT	85	M2
VOLUME	8190	CUFT	232	M3

	COOLING LOAD		HEATING LOAD
TIME	AUG 31	1PM	DEC 10 11AM
DRY-BULB TEMP	70F	21C	-22F -30C
WET-BULB TEMP	54F	12C	-22F -30C

	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	SENSIBLE (KBTU/H)	SENSIBLE (KW)
WALLS	0.000	0.000	0.000	0.000	0.000	0.000
ROOFS	5.208	1.525	0.000	0.000	-7.288	-2.134
GLASS CONDUCTION	0.000	0.000	0.000	0.000	0.000	0.000
GLASS SOLAR	0.000	0.000	0.000	0.000	0.000	0.000
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.060	-0.018	0.000	0.000	-2.294	-0.672
OCCUPANTS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
LIGHT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	19.155	5.610	53.550	15.683	0.006	0.002
INFILTRATION	0.000	0.000	0.000	0.000	-4.789	-1.402
TOTAL	24.303	7.118	53.550	15.683	-14.365	-4.207
TOTAL LOAD	77.853 KBTU/H		22.801 KW		-14.365 KBTU/H	-4.207 KW
TOTAL LOAD / AREA	85.55BTU/H.SQFT		269.702 W / M2		15.786BTU/H.SQFT	49.764 W / M2

NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

SPACE GYM

MULTIPLIER	1.0		FLOOR MULTIPLIER	1.0
FLOOR AREA	8150	SQFT	757	M2
VOLUME	203750	CUFT	5770	M3

	COOLING LOAD		HEATING LOAD
TIME	AUG 24	5PM	JAN 23 3PM
DRY-BULB TEMP	78F	26C	-13F -25C
WET-BULB TEMP	66F	19C	-14F -26C

	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	SENSIBLE (KBTU/H)	SENSIBLE (KW)
WALLS	23.929	7.008	0.000	0.000	-44.617	-13.067
ROOFS	18.125	5.308	0.000	0.000	-30.931	-9.059
GLASS CONDUCTION	0.000	0.000	0.000	0.000	0.000	0.000
GLASS SOLAR	0.000	0.000	0.000	0.000	0.000	0.000
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.398	-0.117	0.000	0.000	-21.063	-6.169
OCCUPANTS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
LIGHT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	42.729	12.514	17.660	5.172	-128.805	-37.724
TOTAL	84.385	24.714	17.660	5.172	-225.416	-66.019
TOTAL LOAD	102.045 KBTU/H		29.886 KW		-225.416 KBTU/H	-66.019 KW
TOTAL LOAD / AREA	12.52BTU/H.SQFT		39.472 W / M2		27.658BTU/H.SQFT	87.193 W / M2

NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

SPACE ADJ_TO_GYM

MULTIPLIER	1.0		FLOOR MULTIPLIER	1.0
FLOOR AREA	7097	SQFT	659	M2
VOLUME	63873	CUFT	1809	M3

	COOLING LOAD		HEATING LOAD	
TIME	AUG 14	3PM	FEB 5	5AM
DRY-BULB TEMP	82F	28C	-44F	-42C
WET-BULB TEMP	63F	17C	-44F	-42C

	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	SENSIBLE (KBTU/H)	SENSIBLE (KW)
WALLS	26.811	7.852	0.000	0.000	-44.374	-12.996
ROOFS	32.161	9.419	0.000	0.000	-46.851	-13.721
GLASS CONDUCTION	0.000	0.000	0.000	0.000	0.000	0.000
GLASS SOLAR	0.000	0.000	0.000	0.000	0.000	0.000
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.398	-0.117	0.000	0.000	-24.577	-7.198
OCCUPANTS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
LIGHT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	1.375	0.403	0.000	0.000	-8.210	-2.405
TOTAL	59.949	17.558	0.000	0.000	-124.013	-36.320
TOTAL LOAD	59.949 KBTU/H		17.558 KW		-124.013 KBTU/H	-36.320 KW
TOTAL LOAD / AREA	8.45BTU/H.SQFT		26.629 W / M2		17.474BTU/H.SQFT	55.087 W / M2

NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 LDL RUN 1
DENVER, CO 80227
REPORT- LS-B SPACE PEAK LOAD COMPONENTS DIN&MP BIG DELTA, AK

SPACE DIN&MP

MULTIPLIER	1.0		FLOOR MULTIPLIER	1.0
FLOOR AREA	4900	SQFT	455	M2
VOLUME	98000	CUFT	2775	M3

	COOLING LOAD		HEATING LOAD	
TIME	AUG 24	5PM	JAN 23	3PM
DRY-BULB TEMP	78F	26C	-13F	-25C
WET-BULB TEMP	66F	19C	-14F	-26C

	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	SENSIBLE (KBTU/H)	SENSIBLE (KW)
WALLS	15.459	4.528	0.000	0.000	-29.546	-8.653
ROOFS	12.806	3.751	0.000	0.000	-21.855	-6.401
GLASS CONDUCTION	0.000	0.000	0.000	0.000	0.000	0.000
GLASS SOLAR	0.000	0.000	0.000	0.000	0.000	0.000
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-0.281	-0.082	0.000	0.000	-14.882	-4.359
OCCUPANTS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
LIGHT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	20.552	6.019	8.494	2.488	-61.953	-18.144
TOTAL	48.536	14.215	8.494	2.488	-128.236	-37.557
TOTAL LOAD	57.030 KBTU/H		16.703 KW		-128.236 KBTU/H	-37.557 KW
TOTAL LOAD / AREA	11.64BTU/H.SQFT		36.691 W / M2		26.171BTU/H.SQFT	82.502 W / M2

NOTE 1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

*** BUILDING ***

FLOOR AREA 50228 SQFT 4666 SQMT
VOLUME 636352 CUFT 18021 CUMT

	COOLING LOAD				HEATING LOAD	
TIME	JUL 12 5PM				DEC 10 11AM	
DRY-BULB TEMP	87F 31C				-22F -30C	
WET-BULB TEMP	65F 18C				-22F -30C	
	SENSIBLE (KBTU/H)	SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	SENSIBLE (KBTU/H)	SENSIBLE (KW)
WALLS	136.150	39.875	0.000	0.000	-200.787	-58.805
ROOFS	216.453	63.394	0.000	0.000	-256.246	-75.048
GLASS CONDUCTION	65.351	19.140	0.000	0.000	-114.412	-33.508
GLASS SOLAR	144.633	42.359	0.000	0.000	0.099	0.029
DOOR	0.000	0.000	0.000	0.000	0.000	0.000
INTERNAL SURFACES	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURFACES	-28.731	-8.414	0.000	0.000	-107.282	-31.420
OCCUPANTS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
LIGHT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
EQUIPMENT TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.006	0.002
INFILTRATION	54.233	15.883	0.000	0.000	-372.077	-108.972
TOTAL	588.090	172.237	0.000	0.000	-1050.699	-307.723
TOTAL LOAD	588.090 KBTU/H		172.237 KW		-1050.699 KBTU/H	-307.723 KW
TOTAL LOAD / AREA	11.71BTU/H.SQFT		36.911 W /SQMT		20.919BTU/H.SQFT	65.945 W /SQMT

NOTE 1) THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR LOADS
2) TIMES GIVEN IN STANDARD TIME FOR THE LOCATION IN CONSIDERATION

	COOLING					HEATING					ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.24552	16	13	13.F	11.F	11.293	-501.698	23	15	-13.F	-14.F	-1021.075	0.	0.000
FEB	0.46224	28	15	36.F	30.F	32.655	-398.054	4	5	-24.F	-24.F	-987.984	0.	0.000
MAR	4.75387	25	16	37.F	31.F	134.512	-340.065	2	3	-45.F	-45.F	-947.695	0.	0.000
APR	15.05133	29	14	47.F	34.F	209.173	-191.743	19	5	-13.F	-14.F	-668.801	0.	0.000
MAY	66.20088	26	16	60.F	49.F	344.653	-57.704	2	5	26.F	24.F	-278.492	0.	0.000
JUN	125.88889	4	16	81.F	56.F	506.291	-11.226	15	3	41.F	40.F	-137.710	0.	0.000
JUL	155.45750	12	16	87.F	65.F	588.090	-2.439	28	3	38.F	37.F	-93.044	0.	0.000
AUG	134.73952	14	17	82.F	61.F	563.373	-3.395	21	5	37.F	36.F	-91.874	0.	0.000
SEP	47.17384	1	16	65.F	54.F	438.907	-30.308	21	6	20.F	18.F	-233.395	0.	0.000
OCT	3.89749	8	16	39.F	33.F	108.644	-157.455	29	6	-6.F	-7.F	-459.405	0.	0.000
NOV	0.40414	15	13	25.F	23.F	15.438	-319.658	3	2	-24.F	-24.F	-679.169	0.	0.000
DEC	0.26241	28	13	9.F	7.F	12.399	-470.001	10	11	-22.F	-22.F	-1050.699	0.	0.000
TOTAL	554.538						-2483.746						0.	
MAX						588.090						-1050.699		0.000

MMDDHH	BUILDING SENSIBLE HTG LOAD BTU/HR ----(1)	BUILDING LATENT HTG LOAD BTU/HR ----(2)	GLOBAL DRY BULB TEMP F ----(4)	GLOBAL GROUND ABS TEMP R ----(2)	GLOBAL SNOW FLAG ----(7)
MONTHLY SUMMARY (JAN)					
MN	-1021075.	0.	-42.0	474.6	0.
MX	-411295.	32160.	18.0	474.6	1.
SM	-501698784.	2056880.	-3378.0	353122.9	100.
AV	-674326.	2765.	-4.5	474.6	0.
MONTHLY SUMMARY (FEB)					
MN	-987984.	0.	-44.0	469.6	0.
MX	-168261.	32160.	40.0	469.6	1.
SM	-398053600.	1850120.	1340.0	315544.8	10.
AV	-592342.	2753.	2.0	469.6	0.
MONTHLY SUMMARY (MAR)					
MN	-947695.	0.	-53.0	469.2	0.
MX	-75091.	17240.	42.0	469.2	1.
SM	-340064384.	1986290.	6894.0	349051.3	48.
AV	-457076.	2670.	9.3	469.2	0.
MONTHLY SUMMARY (APR)					
MN	-668801.	0.	-13.0	471.6	0.
MX	0.	17240.	52.0	471.6	1.
SM	-191743040.	1360710.	19827.0	339522.8	68.
AV	-266310.	1890.	27.5	471.6	0.
MONTHLY SUMMARY (MAY)					
MN	-278492.	0.	25.0	481.2	0.
MX	0.	7970.	70.0	481.2	1.
SM	-57703676.	298540.	35459.0	358021.8	2.
AV	-77559.	401.	47.7	481.2	0.
MONTHLY SUMMARY (JUN)					
MN	-137710.	0.	41.0	490.8	0.
MX	0.	280.	82.0	490.8	0.
SM	-11226243.	1680.	41425.0	353390.3	0.
AV	-15592.	2.	57.5	490.8	0.
MONTHLY SUMMARY (JUL)					
MN	-93044.	0.	38.0	499.1	0.
MX	0.	0.	87.0	499.1	0.
SM	-2438502.	0.	44355.0	371367.1	0.
AV	-3278.	0.	59.6	499.1	0.

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 LDL RUN 1
DENVER, CO 80227
LDS_RPT_1 = HOURLY-REPORT BIG DELTA, AK

	BUILDING SENSIBLE HTG LOAD BTU/HR ----(1)	BUILDING LATENT HTG LOAD BTU/HR ----(2)	GLOBAL DRY BULB TEMP F ----(4)	GLOBAL GROUND ABS TEMP R ----(2)	GLOBAL SNOW FLAG ----(7)
MONTHLY SUMMARY (AUG)					
MN	-91874.	0.	37.0	504.4	0.
MX	0.	1290.	82.0	504.4	0.
SM	-3395090.	3530.	41588.0	375292.8	0.
AV	-4563.	5.	55.9	504.4	0.
MONTHLY SUMMARY (SEP)					
MN	-233395.	0.	18.0	504.9	0.
MX	0.	7970.	68.0	504.9	1.
SM	-30308414.	288340.	30923.0	363509.2	15.
AV	-42095.	400.	42.9	504.9	0.
MONTHLY SUMMARY (OCT)					
MN	-459405.	0.	-7.0	500.6	0.
MX	-1790.	17240.	45.0	500.6	1.
SM	-157455056.	1111680.	18356.0	372433.1	38.
AV	-211633.	1494.	24.7	500.6	0.
MONTHLY SUMMARY (NOV)					
MN	-679169.	0.	-30.0	492.5	0.
MX	-210139.	17240.	35.0	492.5	1.
SM	-319657920.	1781850.	5216.0	354575.3	39.
AV	-443969.	2475.	7.2	492.5	0.
MONTHLY SUMMARY (DEC)					
MN	-1050699.	0.	-47.0	483.2	0.
MX	-392634.	32160.	20.0	483.2	1.
SM	-470000704.	1960350.	-4934.0	359465.4	28.
AV	-631721.	2635.	-6.6	483.2	0.
YEARLY SUMMARY					
MN	-1050699.	0.	-53.0	469.2	0.
MX	0.	32160.	87.0	504.9	1.
SM	-2483745280.	12699970.	237071.0	4265296.5	348.
AV	-283533.	1450.	27.1	486.9	0.

SYSTEM NAME: H&V1&2 — ALTITUDE MULTIPLIER: 1.000

SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)
15900.	9.381	2.4	14310.	0.000	0.0	0.000	0.000	0.000	-1034.000	0.00	0.00

ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	EXTRACTION SENSIBLE (SHR)	EXTRACTION RATE CAPACITY (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER
INTERIOR_C	15900.	0.	0.000	1.000	0.	0.00	0.00	0.00	0.00	-1078.04	1.0

SYSTEM NAME	ALTITUDE MULTIPLIER											
BB_RAD	1.000											
SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)	
0.	0.000	0.0	0.	0.000	0.0	0.000	0.000	0.000	0.000	0.00	0.00	
ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER	
EXTER_ZN_C	0.	0.	0.000	0.000	0.	0.00	0.00	0.00	0.00	-331.20	1.0	

SYSTEM NAME	ALTITUDE MULTIPLIER											
KIT_MAU	1.000											
SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)	
2500.	1.475	2.4	0.	0.000	0.0	1.000	0.000	0.000	-209.434	0.00	0.00	
ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER	
KITCHEN	2500.	0.	0.000	1.000	2500.	0.00	0.00	0.00	0.00	-37.19	1.0	

SYSTEM NAME	ALTITUDE MULTIPLIER											
GYM_HV	1.000											
SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)	
13775.	8.127	2.4	11708.	0.000	0.0	0.150	0.000	0.000	-700.000	0.00	0.00	
ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER	
GYM	10331.	0.	0.000	1.000	1550.	0.00	0.00	0.00	0.00	-412.70	1.0	
ADJ_TO_GYM	3444.	0.	0.000	1.000	517.	0.00	0.00	0.00	0.00	-137.58	1	

SYSTEM NAME	ALTITUDE MULTIPLIER											
MPHVU	1.000											
SUPPLY FAN (CFM)	ELEC (KW)	DELTA-T (F)	RETURN FAN (CFM)	ELEC (KW)	DELTA-T (F)	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)	
4500.	2.655	2.4	3825.	0.000	0.0	0.150	0.000	0.000	-89.203	0.00	0.00	
ZONE NAME	SUPPLY FLOW	EXHAUST FLOW	FAN (KW)	MINIMUM FLOW RATIO	OUTSIDE AIR FLOW	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	MULTIPLIER	
DIN&MP	4500.	0.	0.000	1.000	675.	0.00	0.00	0.00	0.00	-106.16	1.0	

	COOLING					HEATING					ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELECTRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-901.605	23	12	-14.F	-15.F	-2280.545	15063.	21.638
FEB	0.00000					0.000	-736.288	3	12	-29.F	-29.F	-2179.429	13606.	21.638
MAR	0.00000					0.000	-673.526	3	12	-20.F	-21.F	-2006.820	15069.	21.638
APR	0.00000					0.000	-465.717	19	11	7.F	3.F	-1643.971	14576.	21.638
MAY	0.00000					0.000	-241.675	14	7	33.F	29.F	-834.253	15066.	21.638
JUN	0.00000					0.000	-84.414	15	4	41.F	40.F	-635.677	2438.	21.638
JUL	0.00000					0.000	-66.064	27	7	44.F	41.F	-255.440	0.	0.000
AUG	0.00000					0.000	-87.689	26	2	47.F	44.F	-986.388	2915.	21.638
SEP	0.00000					0.000	-228.937	27	8	26.F	23.F	-784.591	14576.	21.638
OCT	0.00000					0.000	-459.873	25	12	12.F	11.F	-1320.184	15063.	21.638
NOV	0.00000					0.000	-667.016	2	11	-6.F	-7.F	-1652.033	14576.	21.638
DEC	0.00000					0.000	-857.482	11	11	-21.F	-21.F	-2339.024	15060.	21.638
TOTAL	0.000						-5470.289						138014.	
MAX						0.000						-2339.024		21.638

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR H&V1&2 BIG DELTA, AK

	COOLING					HEATING					ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-340.431	22 12	-19.F	-19.F	-781.576	6979.	9.381
FEB	0.00000				0.000	-279.998	5 15	-14.F	-14.F	-750.689	6304.	9.381
MAR	0.00000				0.000	-257.729	5 10	-14.F	-15.F	-695.093	6979.	9.381
APR	0.00000				0.000	-180.311	19 7	-4.F	-6.F	-544.811	6754.	9.381
MAY	0.00000				0.000	-92.871	14 7	33.F	29.F	-314.180	6979.	9.381
JUN	0.00000				0.000	-4.779	15 4	41.F	40.F	-334.907	1135.	9.381
JUL	0.00000				0.000	0.000				0.000	0.	0.000
AUG	0.00000				0.000	-7.367	28 7	38.F	36.F	-174.432	1351.	9.381
SEP	0.00000				0.000	-84.786	21 7	20.F	18.F	-294.218	6754.	9.381
OCT	0.00000				0.000	-172.448	29 9	-2.F	-3.F	-444.164	6979.	9.381
NOV	0.00000				0.000	-250.178	23 12	1.F	0.F	-583.308	6754.	9.381
DEC	0.00000				0.000	-323.381	10 11	-22.F	-22.F	-803.178	6979.	9.381
TOTAL	0.000					-1994.280					63956.	
MAX					0.000					-803.178		9.381

REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR H&V1&2 BIG DELTA, AK

	NUMBER OF HOURS										--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-325.011	9.381
FEB	0	672	0	0	672	0	672	0	0	0	-262.092	9.381
MAR	0	744	0	0	744	0	744	0	0	0	-216.412	9.381
APR	0	720	0	0	720	0	720	0	0	0	-170.349	9.381
MAY	0	733	0	11	744	0	744	0	0	11	-113.415	9.381
JUN	0	102	0	618	720	0	121	1	0	19	0.000	0.000
JUL	0	0	0	744	744	0	0	0	0	0	0.000	0.000
AUG	0	123	0	621	744	0	144	0	0	21	-1.187	9.381
SEP	0	701	0	19	720	0	720	0	0	19	-124.760	9.381
OCT	0	744	0	0	744	0	744	0	0	0	-255.198	9.381
NOV	0	720	0	0	720	0	720	0	0	0	-267.439	9.381
DEC	0	744	0	0	744	0	744	0	0	0	-302.796	9.381
ANNUAL	0	6747	0	2013	8760	0	6817	1	0	70		

REPORT- SS-K SPACE TEMPERATURE SUMMARY H&V1&2 BIG DELTA, AK

	AVERAGE SPACE TEMP					AVERAGE TEMPERATURE DIFFERENCE BETWEEN OUTDOOR& ROOM AIR			SUMMED TEMP DIFFERENCE BETWEEN OUTDOOR& ROOM AIR		
MONTH	ALL HOURS (F)	COOLING HOURS (F)	HEATING HOURS (F)	FAN ON HOURS (F)	FAN OFF HOURS (F)	ALL HOURS (F)	FAN ON HOURS (F)	FAN OFF HOURS (F)	HEATING HOURS (F)	ALL HOURS (F)	HUMIDITY RATIO DIFFERENCE BETWEEN OUTDOOR AND ROOM AIR (FRAC.OR MULT.)
JAN	70.16		70.16	70.16	0.00	-74.70	-74.70	0.00	2315.83	2315.83	-0.00413
FEB	70.23		70.23	70.23	0.00	-68.24	-68.24	0.00	1910.74	1910.74	-0.00397
MAR	70.36		70.36	70.36	0.00	-61.10	-61.10	0.00	1894.05	1894.05	-0.00347
APR	70.54		70.54	70.54	0.00	-43.00	-43.00	0.00	1290.14	1290.14	-0.00282
MAY	70.77		70.77	70.77	0.00	-23.11	-23.11	0.00	712.30	716.43	-0.00094
JUN	70.31		71.35	71.38	70.09	-12.77	-9.42	-13.45	51.97	402.54	0.00063
JUL	70.38			0.00	70.38	-10.76	0.00	-10.76			0.00210
AUG	70.43		71.08	71.17	70.25	-14.53	-15.94	-14.19	94.24	466.85	0.00113
SEP	70.80		70.78	70.80	0.00	-27.85	-27.85	0.00	828.13	835.51	-0.00088
OCT	70.58		70.58	70.58	0.00	-45.90	-45.90	0.00	1423.01	1423.01	-0.00260
NOV	70.37		70.37	70.37	0.00	-63.13	-63.13	0.00	1893.75	1893.75	-0.00366
DEC	70.21		70.21	70.21	0.00	-76.84	-76.84	0.00	2381.95	2381.95	-0.00393
ANNUAL	70.43	0.00	70.47	70.48	70.25	-43.37	-52.12	-12.65	14796.08	15892.44	-0.00186

REPORT- SS-N RELATIVE HUMIDITY SCATTER PLOT FOR H&V1&2 BIG DELTA, AK

TOTAL HOURS AT RELATIVE HUMIDITY LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
81-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61-70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41-50	1	1	1	2	0	1	1	1	1	2	3	1	2	3	2	4	4	3	2	2	2	1	2	2	44
31-40	18	18	18	17	19	23	25	21	22	26	22	23	25	20	24	20	26	23	26	28	24	25	22	19	534
0-30	265	265	265	265	265	260	258	262	261	256	259	260	257	261	258	260	254	258	256	254	258	258	260	263	6238

TOTAL HOURS AT TEMPERATURE LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
ABOVE 85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81-85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71-75	284	284	284	284	284	284	251	249	243	241	242	247	249	250	250	280	280	283	283	283	284	284	284	284	6471
66-70	0	0	0	0	0	0	33	35	41	43	42	37	35	34	34	4	4	1	1	1	0	0	0	0	345
61-65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BELOW 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	COOLING					HEATING					ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-165.031	22 12	-19.F	-19.F	-303.256	0.	0.000
FEB	0.00000				0.000	-132.407	3 9	-39.F	-39.F	-305.916	0.	0.000
MAR	0.00000				0.000	-114.794	2 8	-40.F	-40.F	-283.448	0.	0.000
APR	0.00000				0.000	-73.378	19 8	0.F	-2.F	-206.496	0.	0.000
MAY	0.00000				0.000	-31.942	3 6	32.F	30.F	-109.470	0.	0.000
JUN	0.00000				0.000	-53.947	15 4	41.F	40.F	-238.625	0.	0.000
JUL	0.00000				0.000	-47.831	27 6	43.F	41.F	-202.077	0.	0.000
AUG	0.00000				0.000	-50.163	21 7	37.F	37.F	-190.350	0.	0.000
SEP	0.00000				0.000	-40.442	27 8	26.F	23.F	-124.336	0.	0.000
OCT	0.00000				0.000	-85.854	29 8	-7.F	-8.F	-186.175	0.	0.000
NOV	0.00000				0.000	-124.411	2 8	-21.F	-21.F	-237.976	0.	0.000
DEC	0.00000				0.000	-160.982	10 11	-22.F	-22.F	-314.897	0.	0.000
TOTAL	0.000					-1081.184					0.	
MAX					0.000					-314.897		0.000

	NUMBER OF HOURS										--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	744	744	0	0	0	-189.332	0.000
FEB	0	672	0	0	672	672	672	0	0	0	-149.217	0.000
MAR	0	744	0	0	744	744	744	0	0	0	-110.976	0.000
APR	0	714	0	6	720	720	720	0	0	6	-77.883	0.000
MAY	0	610	0	134	744	744	744	0	0	134	-53.765	0.000
JUN	0	553	0	167	720	720	720	0	0	167	-65.002	0.000
JUL	0	553	0	191	744	744	744	0	0	191	0.000	0.000
AUG	0	585	0	159	744	744	744	0	0	159	0.000	0.000
SEP	0	649	0	71	720	720	720	0	0	71	-76.723	0.000
OCT	0	744	0	0	744	744	744	0	0	0	-160.645	0.000
NOV	0	720	0	0	720	720	720	0	0	0	-168.340	0.000
DEC	0	744	0	0	744	744	744	0	0	0	-178.452	0.000
ANNUAL	0	8032	0	728	8760	8760	8760	0	0	728		

	AVERAGE SPACE TEMP					AVERAGE TEMPERATURE DIFFERENCE BETWEEN OUTDOOR& ROOM AIR			SUMMED TEMP DIFFERENCE BETWEEN OUTDOOR& ROOM AIR		
MONTH	ALL HOURS (F)	COOLING HOURS (F)	HEATING HOURS (F)	FAN ON HOURS (F)	FAN OFF HOURS (F)	ALL HOURS (F)	FAN ON HOURS (F)	FAN OFF HOURS (F)	HEATING HOURS (F)	ALL HOURS (F)	HUMIDITY RATIO DIFFERENCE BETWEEN OUTDOOR AND ROOM AIR (FRAC.OR MULT.)
JAN	69.66		69.66	69.66	0.00	-74.20	-74.20	0.00	2300.23	2300.23	0.00000
FEB	69.81		69.81	69.81	0.00	-67.82	-67.82	0.00	1898.85	1898.85	0.00000
MAR	70.07		70.07	70.07	0.00	-60.80	-60.80	0.00	1884.87	1884.87	0.00000
APR	70.39		70.38	70.39	0.00	-42.85	-42.85	0.00	1278.79	1285.44	0.00000
MAY	70.78		70.68	70.78	0.00	-23.12	-23.12	0.00	648.59	716.72	0.00000
JUN	70.72		70.41	70.72	0.00	-13.18	-13.18	0.00	367.71	412.24	0.00000
JUL	70.76		70.48	70.76	0.00	-11.14	-11.14	0.00	321.39	370.27	0.00000
AUG	70.73		70.48	70.73	0.00	-14.83	-14.83	0.00	417.29	474.40	0.00000
SEP	70.70		70.62	70.70	0.00	-27.75	-27.75	0.00	786.07	832.40	0.00000
OCT	70.30		70.30	70.30	0.00	-45.63	-45.63	0.00	1414.56	1414.56	0.00000
NOV	69.96		69.96	69.96	0.00	-62.71	-62.71	0.00	1881.36	1881.36	0.00000
DEC	69.69		69.69	69.69	0.00	-76.33	-76.33	0.00	2366.08	2366.08	0.00000
ANNUAL	70.30	0.00	70.19	70.30	0.00	-43.24	-43.24	0.00	15565.79	15837.43	0.00000

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 SDL RUN 1
DENVER, CO 80227
REPORT- SS-N RELATIVE HUMIDITY SCATTER PLOT FOR BB_RAD BIG DELTA, AK

TOTAL HOURS AT RELATIVE HUMIDITY LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
81-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61-70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 SDL RUN 1
DENVER, CO 80227
REPORT- SS-O TEMPERATURE SCATTER PLOT BB_RAD FOR EXTER_ZN_C BIG DELTA, AK

TOTAL HOURS AT TEMPERATURE LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
ABOVE 85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81-85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71-75	242	239	232	231	225	227	226	222	226	232	240	246	251	255	257	252	265	261	258	258	260	255	254	253	5867
66-70	123	126	133	134	140	138	139	143	139	133	125	119	114	110	108	113	100	104	107	107	105	110	111	112	2893
61-65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BELOW 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 SDL RUN 1
DENVER, CO 80227
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR KIT_MAU BIG DELTA, AK

	COOLING					HEATING					ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELECTRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-10.566	20 11	-34.F	-34.F	-380.768	62.	1.475
FEB	0.00000				0.000	-8.553	3 11	-32.F	-32.F	-368.192	56.	1.475
MAR	0.00000				0.000	-8.174	3 11	-21.F	-22.F	-327.682	68.	1.475
APR	0.00000				0.000	-5.401	18 11	0.F	-2.F	-236.454	59.	1.475
MAY	0.00000				0.000	-2.045	2 11	35.F	30.F	-104.786	65.	1.475
JUN	0.00000				0.000	-0.017	2 12	66.F	52.F	-7.848	9.	1.475
JUL	0.00000				0.000	0.000				0.000	0.	0.000
AUG	0.00000				0.000	-0.095	28 11	58.F	48.F	-29.563	12.	1.475
SEP	0.00000				0.000	-2.643	21 11	38.F	30.F	-104.891	59.	1.475
OCT	0.00000				0.000	-5.615	25 11	7.F	5.F	-202.348	62.	1.475
NOV	0.00000				0.000	-7.462	2 11	-6.F	-7.F	-256.952	59.	1.475
DEC	0.00000				0.000	-10.451	8 11	-43.F	-43.F	-410.249	59.	1.475
TOTAL	0.000					-61.021					569.	
MAX					0.000					-410.249		1.475

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 SDL RUN 1
DENVER, CO 80227
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR KIT_MAU BIG DELTA, AK

	NUMBER OF HOURS										--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	42	0	702	744	0	42	0	0	0	0.000	0.000
FEB	0	38	0	634	672	0	38	0	0	0	0.000	0.000
MAR	0	46	0	698	744	0	46	0	0	0	0.000	0.000
APR	0	40	0	680	720	0	40	0	0	0	0.000	0.000
MAY	0	44	0	700	744	0	44	0	0	0	0.000	0.000
JUN	0	3	0	717	720	0	6	0	0	3	0.000	0.000
JUL	0	0	0	744	744	0	0	0	0	0	0.000	0.000
AUG	0	7	0	737	744	0	8	0	0	1	0.000	0.000
SEP	0	40	0	680	720	0	40	0	0	0	0.000	0.000
OCT	0	42	0	702	744	0	42	0	0	0	0.000	0.000
NOV	0	40	0	680	720	0	40	0	0	0	0.000	0.000
DEC	0	40	0	704	744	0	40	0	0	0	0.000	0.000
ANNUAL	0	382	0	8378	8760	0	386	0	0	4		

REPORT- SS-K SPACE TEMPERATURE SUMMARY KIT_MAU BIG DELTA, AK

MONTH	AVERAGE SPACE TEMP ALL HOURS (F)	COOLING HOURS (F)	HEATING HOURS (F)	FAN ON HOURS (F)	FAN OFF HOURS (F)	AVERAGE TEMPERATURE DIFFERENCE BETWEEN OUTDOOR& ROOM AIR ALL HOURS (F)	BETWEEN OUTDOOR& ROOM AIR FAN ON HOURS (F)	BETWEEN OUTDOOR& ROOM AIR FAN OFF HOURS (F)	SUMMED TEMP DIFFERENCE BETWEEN OUTDOOR& ROOM AIR HEATING HOURS (F)	BETWEEN OUTDOOR& ROOM AIR ALL HOURS (F)	HUMIDITY RATIO DIFFERENCE BETWEEN OUTDOOR A ROOM AIR (FRAC.OR MULT.)
JAN	69.34		69.12	69.12	69.35	-73.88	-72.05	-73.99	126.09	2290.34	-0.00451
FEB	69.49		69.33	69.33	69.49	-67.49	-64.97	-67.64	102.86	1889.76	-0.00386
MAR	69.73		69.70	69.70	69.73	-60.46	-52.16	-61.01	99.97	1874.29	-0.00363
APR	70.06		69.95	69.95	70.07	-42.52	-41.50	-42.58	69.17	1275.70	-0.00293
MAY	70.48		70.59	70.59	70.47	-22.82	-17.05	-23.18	31.25	707.39	-0.00139
JUN	70.15		70.93	71.27	70.14	-12.61	-1.43	-12.71	0.49	399.96	-0.00029
JUL	70.22			0.00	70.22	-10.61	0.00	-10.61			0.00105
AUG	70.29		70.96	70.98	70.28	-14.39	-4.86	-14.50	2.19	463.94	0.00013
SEP	70.55		70.43	70.43	70.55	-27.60	-25.30	-27.73	42.17	827.98	-0.00129
OCT	70.17		69.94	69.94	70.18	-45.50	-44.32	-45.57	77.55	1410.43	-0.00279
NOV	69.77		69.55	69.55	69.78	-62.52	-57.33	-62.83	95.55	1875.66	-0.00372
DEC	69.43		69.13	69.13	69.45	-76.06	-75.33	-76.10	125.55	2357.95	-0.00422
ANNUAL	69.97	0.00	69.79	69.81	69.98	-42.91	-48.01	-42.68	772.84	15733.04	-0.00228

REPORT- SS-N RELATIVE HUMIDITY SCATTER PLOT FOR KIT_MAU BIG DELTA, AK

TOTAL HOURS AT RELATIVE HUMIDITY LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
81-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61-70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41-50	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	10
31-40	0	0	0	0	0	0	0	0	0	25	22	0	0	0	0	0	0	0	0	0	0	0	0	0	47
0-30	0	0	0	0	0	0	0	0	0	58	166	105	0	0	0	0	0	0	0	0	0	0	0	0	329

REPORT- SS-O TEMPERATURE SCATTER PLOT KIT_MAU FOR KITCHEN BIG DELTA, AK

TOTAL HOURS AT TEMPERATURE LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
ABOVE 85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81-85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71-75	0	0	0	0	0	0	0	0	0	68	79	14	0	0	0	0	0	0	0	0	0	0	0	0	161
66-70	0	0	0	0	0	0	0	0	0	20	114	91	0	0	0	0	0	0	0	0	0	0	0	0	225
61-65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BELOW 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR GYM_HV BIG DELTA, AK

MONTH	COOLING COOLING ENERGY (MBTU)	COOLING TIME OF MAX DY	COOLING TIME OF MAX HR	COOLING DRY-BULB TEMP	COOLING WET-BULB TEMP	COOLING MAXIMUM LOAD (KBTU/HR)	HEATING HEATING ENERGY (MBTU)	HEATING TIME OF MAX DY	HEATING TIME OF MAX HR	HEATING DRY-BULB TEMP	HEATING WET-BULB TEMP	HEATING MAXIMUM LOAD (KBTU/HR)	ELEC ELEC-TRICAL ENERGY (KWH)	ELEC MAXIMUM ELEC LOAD (KW)
JAN	0.00000					0.000	-287.288	22	12	-19.F	-19.F	-783.515	6047.	8.127
FEB	0.00000					0.000	-234.413	5	14	-14.F	-14.F	-748.953	5462.	8.127
MAR	0.00000					0.000	-217.386	5	10	-14.F	-15.F	-694.692	6047.	8.127
APR	0.00000					0.000	-152.960	19	11	7.F	3.F	-555.255	5852.	8.127
MAY	0.00000					0.000	-85.185	14	9	36.F	31.F	-328.400	6047.	8.127
JUN	0.00000					0.000	-4.784	3	7	51.F	48.F	-134.319	975.	8.127
JUL	0.00000					0.000	0.000					0.000	0.	0.000
AUG	0.00000					0.000	-11.256	26	3	46.F	44.F	-666.254	1170.	8.127
SEP	0.00000					0.000	-75.029	22	8	27.F	24.F	-299.399	5852.	8.127
OCT	0.00000					0.000	-145.195	29	9	-2.F	-3.F	-437.909	6047.	8.127
NOV	0.00000					0.000	-211.454	23	15	1.F	0.F	-605.043	5852.	8.127
DEC	0.00000					0.000	-270.071	10	11	-22.F	-22.F	-789.968	6047.	8.127
TOTAL	0.000						-1695.022						55399.	
MAX						0.000						-789.968		8.127

REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR GYM_HV BIG DELTA, AK

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	--COINCIDENT LOADS-- HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
	NUMBER OF HOURS											
JAN	0	744	0	0	744	0	744	0	0	0	-328.313	8.127
FEB	0	672	0	0	672	0	672	0	0	0	-296.136	8.127
MAR	0	744	0	0	744	0	744	0	0	0	-240.760	8.127
APR	0	720	0	0	720	0	720	0	0	0	-207.267	8.127
MAY	0	744	0	0	744	0	744	0	0	0	-135.091	8.127
JUN	0	107	0	613	720	0	120	0	0	13	0.000	0.000
JUL	0	0	0	744	744	0	0	0	0	0	0.000	0.000
AUG	0	134	0	610	744	0	144	0	0	10	-31.388	8.127
SEP	0	715	0	5	720	0	720	0	0	5	-64.419	8.127
OCT	0	744	0	0	744	0	744	0	0	0	-156.706	8.127
NOV	0	720	0	0	720	0	720	0	0	0	-129.822	8.127
DEC	0	744	0	0	744	0	744	0	0	0	-164.897	8.127
ANNUAL	0	6788	0	1972	8760	0	6816	0	0	28		

REPORT- SS-K SPACE TEMPERATURE SUMMARY GYM_HV BIG DELTA, AK

MONTH	AVERAGE SPACE TEMP ALL HOURS (F)	COOLING HOURS (F)	HEATING HOURS (F)	FAN ON HOURS (F)	FAN OFF HOURS (F)	AVERAGE TEMPERATURE DIFFERENCE BETWEEN OUTDOOR& ROOM AIR ALL HOURS (F)	BETWEEN OUTDOOR& ROOM AIR FAN ON HOURS (F)	BETWEEN OUTDOOR& ROOM AIR FAN OFF HOURS (F)	SUMMED TEMP DIFFERENCE BETWEEN OUTDOOR& ROOM AIR HEATING HOURS (F)	BETWEEN OUTDOOR& ROOM AIR ALL HOURS (F)	HUMIDITY RATIO DIFFERENCE BETWEEN OUTDOOR AND ROOM AIR (FRAC.OR MULT.)
JAN	71.39		71.39	71.39	0.00	-75.93	-75.93	0.00	2353.69	2353.69	-0.00432
FEB	71.43		71.43	71.43	0.00	-69.43	-69.43	0.00	1944.14	1944.14	-0.00419
MAR	71.44		71.44	71.44	0.00	-62.18	-62.18	0.00	1927.50	1927.50	-0.00365
APR	71.39		71.39	71.39	0.00	-43.85	-43.85	0.00	1315.62	1315.62	-0.00296
MAY	71.33		71.33	71.33	0.00	-23.67	-23.67	0.00	733.67	733.67	-0.00105
JUN	55.85		71.37	71.40	52.74	1.68	-9.26	3.87	52.42	237.09	0.00079
JUL	54.75			0.00	54.75	4.86	0.00	4.86			0.00227
AUG	56.85		71.28	71.32	53.37	-0.95	-16.09	2.68	99.60	274.45	0.00124
SEP	71.26		71.26	71.26	0.00	-28.31	-28.31	0.00	848.18	849.23	-0.00100
OCT	71.31		71.31	71.31	0.00	-46.64	-46.64	0.00	1445.71	1445.71	-0.00273
NOV	71.28		71.28	71.28	0.00	-64.04	-64.04	0.00	1921.13	1921.13	-0.00382
DEC	71.33		71.33	71.33	0.00	-77.97	-77.97	0.00	2416.94	2416.94	-0.00410
ANNUAL	67.44	0.00	71.35	71.35	53.71	-40.37	-52.99	3.88	15058.60	15640.80	-0.00194

REPORT- SS-N RELATIVE HUMIDITY SCATTER PLOT FOR GYM_HV BIG DELTA, AK

TOTAL HOURS AT RELATIVE HUMIDITY LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
81-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61-70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	0	0	0	0	0	0	6
41-50	2	1	1	2	0	1	1	1	1	2	3	1	1	3	5	13	9	9	2	2	0	1	2	2	65
31-40	143	92	137	97	133	120	152	114	143	106	141	99	138	95	131	100	134	93	144	96	143	96	135	100	2882
0-30	139	191	146	185	151	163	131	169	140	176	140	184	145	186	148	168	140	180	138	186	141	187	147	182	3863

REPORT- SS-O TEMPERATURE SCATTER PLOT GYM_HV FOR GYM BIG DELTA, AK

TOTAL HOURS AT TEMPERATURE LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
ABOVE 85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81-85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71-75	283	283	284	284	284	284	257	271	253	269	252	272	257	272	255	283	284	283	284	283	284	284	284	284	6613
66-70	1	1	0	0	0	0	27	13	31	15	32	12	27	12	29	1	0	1	0	1	0	0	0	0	203
61-65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BELOW 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 SDL RUN 1
DENVER, CO 80227
REPORT- SS-O TEMPERATURE SCATTER PLOT GYM_HV FOR ADJ_TO_GYM BIG DELTA, AK

TOTAL HOURS AT TEMPERATURE LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
ABOVE 85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81-85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71-75	267	241	265	236	261	232	228	193	225	208	225	213	228	215	229	230	266	240	268	239	269	241	270	242	5731
66-70	16	43	19	48	23	52	56	91	59	76	59	71	56	69	55	54	18	44	16	45	15	43	14	42	1084
61-65	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BELOW 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 SDL RUN 1
DENVER, CO 80227
REPORT- SS-A SYSTEM MONTHLY LOADS SUMMARY FOR MPHVU BIG DELTA, AK

	COOLING					HEATING					ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000				0.000	-98.288	23 15	-13.F	-14.F	-195.576	1975.	2.655
FEB	0.00000				0.000	-80.919	5 14	-14.F	-14.F	-187.399	1784.	2.655
MAR	0.00000				0.000	-75.443	5 11	-12.F	-13.F	-186.024	1975.	2.655
APR	0.00000				0.000	-53.667	19 11	7.F	3.F	-162.127	1912.	2.655
MAY	0.00000				0.000	-29.631	14 9	36.F	31.F	-95.031	1975.	2.655
JUN	0.00000				0.000	-20.887	15 3	41.F	40.F	-62.258	319.	2.655
JUL	0.00000				0.000	-18.233	27 7	44.F	41.F	-53.425	0.	0.000
AUG	0.00000				0.000	-18.809	26 2	47.F	44.F	-54.334	382.	2.655
SEP	0.00000				0.000	-26.036	27 10	36.F	31.F	-81.456	1912.	2.655
OCT	0.00000				0.000	-50.762	25 12	12.F	11.F	-128.039	1975.	2.655
NOV	0.00000				0.000	-73.512	23 15	1.F	0.F	-174.631	1912.	2.655
DEC	0.00000				0.000	-92.598	10 11	-22.F	-22.F	-191.043	1975.	2.655
TOTAL	0.000					-638.787					18097.	
MAX					0.000					-195.576		2.655

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 SDL RUN 1
DENVER, CO 80227
REPORT- SS-C SYSTEM MONTHLY LOAD HOURS FOR MPHVU BIG DELTA, AK

	NUMBER OF HOURS										--COINCIDENT LOADS--	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	744	0	0	744	0	744	0	0	0	-94.984	2.655
FEB	0	672	0	0	672	0	672	0	0	0	-78.743	2.655
MAR	0	744	0	0	744	0	744	0	0	0	-65.605	2.655
APR	0	720	0	0	720	0	720	0	0	0	-54.187	2.655
MAY	0	744	0	0	744	0	744	0	0	0	-33.247	2.655
JUN	0	688	0	32	720	0	120	0	0	17	-27.743	0.000
JUL	0	697	0	47	744	0	0	0	0	0	-7.881	0.000
AUG	0	701	0	43	744	0	144	0	0	22	-0.153	2.655
SEP	0	707	0	13	720	0	720	0	0	13	-37.678	2.655
OCT	0	744	0	0	744	0	744	0	0	0	-77.026	2.655
NOV	0	720	0	0	720	0	720	0	0	0	-73.192	2.655
DEC	0	744	0	0	744	0	744	0	0	0	-87.258	2.655
ANNUAL	0	8625	0	135	8760	0	6816	0	0	52		

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 SDL RUN 1
DENVER, CO 80227
REPORT- SS-K SPACE TEMPERATURE SUMMARY MPHVU BIG DELTA, AK

	AVERAGE SPACE TEMP					AVERAGE TEMPERATURE DIFFERENCE BETWEEN OUTDOOR& ROOM AIR			SUMMED TEMP DIFFERENCE BETWEEN OUTDOOR& ROOM AIR		
MONTH	ALL HOURS (F)	COOLING HOURS (F)	HEATING HOURS (F)	FAN ON HOURS (F)	FAN OFF HOURS (F)	ALL HOURS (F)	FAN ON HOURS (F)	FAN OFF HOURS (F)	HEATING HOURS (F)	ALL HOURS (F)	HUMIDITY RATIO DIFFERENCE BETWEEN OUTDOOR AND ROOM AIR (FRAC.OR MULT.)
JAN	69.69		69.69	69.69	0.00	-74.23	-74.23	0.00	2301.19	2301.19	-0.00405
FEB	69.82		69.82	69.82	0.00	-67.82	-67.82	0.00	1898.99	1898.99	-0.00391
MAR	70.01		70.01	70.01	0.00	-60.74	-60.74	0.00	1883.06	1883.06	-0.00342
APR	70.29		70.29	70.29	0.00	-42.75	-42.75	0.00	1282.44	1282.44	-0.00278
MAY	70.61		70.61	70.61	0.00	-22.95	-22.95	0.00	711.44	711.44	-0.00092
JUN	70.26		70.21	71.18	70.08	-12.73	-9.05	-13.46	394.43	402.74	0.00066
JUL	70.32		70.25	0.00	70.32	-10.70	0.00	-10.70	345.62	361.77	0.00210
AUG	70.38		70.32	71.00	70.23	-14.48	-15.77	-14.17	451.83	466.37	0.00114
SEP	70.65		70.64	70.65	0.00	-27.70	-27.70	0.00	825.56	831.03	-0.00087
OCT	70.35		70.35	70.35	0.00	-45.68	-45.68	0.00	1416.02	1416.02	-0.00256
NOV	70.03		70.03	70.03	0.00	-62.79	-62.79	0.00	1883.68	1883.68	-0.00361
DEC	69.76		69.76	69.76	0.00	-76.39	-76.39	0.00	2368.23	2368.23	-0.00386
ANNUAL	70.18	0.00	70.16	70.17	70.22	-43.12	-51.82	-12.63	15762.48	15806.96	-0.00183

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 SDL RUN 1
DENVER, CO 80227
REPORT- SS-N RELATIVE HUMIDITY SCATTER PLOT FOR MPHVU BIG DELTA, AK

TOTAL HOURS AT RELATIVE HUMIDITY LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
81-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61-70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41-50	1	1	1	2	0	1	1	1	1	2	3	2	2	3	3	4	4	3	2	2	2	1	2	2	46
31-40	18	18	18	17	19	24	25	21	22	27	23	22	25	20	23	20	27	23	26	28	27	26	23	19	541
0-30	265	265	265	265	265	259	258	262	261	255	258	260	257	261	258	260	253	258	256	254	255	257	259	263	6229

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 SDL RUN 1
DENVER, CO 80227
REPORT- SS-O TEMPERATURE SCATTER PLOT MPHVU FOR DIN&MP BIG DELTA, AK

TOTAL HOURS AT TEMPERATURE LEVEL AND TIME OF DAY

HOUR	1AM	2	3	4	5	6	7	8	9	10	11	12	1PM	2	3	4	5	6	7	8	9	10	11	12	TOTAL
ABOVE 85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81-85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71-75	224	221	218	213	212	207	145	141	145	150	151	148	151	161	163	194	204	219	220	222	223	223	225	223	4603
66-70	60	63	66	71	72	77	139	143	139	134	133	136	133	123	121	90	80	65	64	62	61	61	59	61	2213
61-65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BELOW 60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 PDL RUN 1
DENVER, CO 80227
REPORT- PV-A EQUIPMENT SIZES BIG DELTA, AK

EQUIPMENT	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL	SIZE (MBTU/H)	NUMBER INSTD	NUMBER AVAIL
HTANK-STORAGE	4.000	1	1															

EMC ENGINEERS INC. EZDOE - ELITE SOFTWARE DEVELOPMENT INC DOE-2.1D 11/28/1995 15:32:37 PDL RUN 1
DENVER, CO 80227
REPORT- PS-A PLANT ENERGY UTILIZATION SUMMARY BIG DELTA, AK

	SITE ENERGY												SOURCE
	2	3	4	5	6	7	8	9	10	11	12	13	14
MONTH	TOTAL HEAT LOAD	TOTAL COOLING LOAD	TOTAL ELECTR LOAD	RCVRED ENERGY	WASTED RCVRABL ENERGY	FUEL INPUT COOLING	ELEC INPUT COOLING	FUEL INPUT HEATING	ELEC INPUT HEATING	FUEL INPUT ELECT	TOTAL FUEL INPUT	TOTAL SITE ENERGY	TOTAL SOURCE ENERGY
JAN	936.0	0.0	57.9 17.0E	0.0	0.0	0.0	0.0 0.0E	0.0	6.5 1.9E	0.0	0.0	993.9	1733.8
FEB	767.4	0.0	52.3 15.3E	0.0	0.0	0.0	0.0 0.0E	0.0	5.8 1.7E	0.0	0.0	819.6	1435.9
MAR	710.1	0.0	57.9 17.0E	0.0	0.0	0.0	0.0 0.0E	0.0	6.5 1.9E	0.0	0.0	768.0	1357.3
APR	498.6	0.0	56.0 16.4E	0.0	0.0	0.0	0.0 0.0E	0.0	6.2 1.8E	0.0	0.0	554.6	999.3
MAY	277.1	0.0	57.9 17.0E	0.0	0.0	0.0	0.0 0.0E	0.0	6.5 1.9E	0.0	0.0	335.0	635.7
JUN	98.5	0.0	14.4 4.2E	0.0	0.0	0.0	0.0 0.0E	0.0	6.1 1.8E	0.0	0.0	112.9	207.4
JUL	76.9	0.0	6.0 1.8E	0.0	0.0	0.0	0.0 0.0E	0.0	6.0 1.8E	0.0	0.0	83.0	146.4
AUG	103.1	0.0	16.1 4.7E	0.0	0.0	0.0	0.0 0.0E	0.0	6.2 1.8E	0.0	0.0	119.3	220.4
SEP	261.8	0.0	56.0 16.4E	0.0	0.0	0.0	0.0 0.0E	0.0	6.2 1.8E	0.0	0.0	317.8	604.4
OCT	494.2	0.0	57.9 17.0E	0.0	0.0	0.0	0.0 0.0E	0.0	6.5 1.9E	0.0	0.0	552.1	997.6
NOV	699.9	0.0	56.0 16.4E	0.0	0.0	0.0	0.0 0.0E	0.0	6.2 1.8E	0.0	0.0	755.9	1334.8
DEC	890.8	0.0	57.9 17.0E	0.0	0.0	0.0	0.0 0.0E	0.0	6.5 1.9E	0.0	0.0	948.6	1658.4
	5814.4	0.0	546.3 160.0E	0.0	0.0	0.0	0.0 0.0E	0.0	75.1 22.0E	0.0	0.0	6360.8	11331.3

NOTE-- ALL ENTRIES ARE IN MBTU EXCEPT
ENTRIES FOLLOWED BY E ARE IN MWH (THOUSANDS OF KWH)

APPENDIX D

WATER AND SEWER ANALYSIS

EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, Co 80227

SUMMARY

#1406.003
Ft. Greely Utility Study
3/18/96
DGM

	Baseline: All buildings in use	Modified complex with each remaining building supplied with utilities through the utilidor.	Modified complex with each remaining building provided with water well, fire protection cistern and soil absorption field	Modified complex with each remaining building provided with domestic water through the utilidor, and a soil absortion field ****	
Area of buildings used (SF)	1,311,194 sf	257,518 sf	257,518 sf	257,518 sf	
Area of buildings abandoned (SF)	0 sf	1,053,676 sf	1,053,676 sf	1,053,676 sf	
Total Area (SF)	1,311,194 sf	1,311,194 sf	1,311,194 sf	1,311,194 sf	
SANITARY SYSTEMS					
Sanitary waste usage per month	7,197,281 Gal/month	816,163 Gal/month	816,163 Gal/month	816,163 Gal/month	from bldg spread sheet
Sanitary sewer system electrical usage (kwh)	251,919 kwh	251,919 kwh	0 kwh	0 kwh	from electrical spread sheet
Cost of electricity per year	$17,911	$17,911	$0	$0	@ $0.0743/kwh
Demand Charge	$1,590	$1,590			@ $6.25/kw-month
Total Cost of Energy per Year	$19,502	$19,502	$0	$0	
DOMESTIC SYSTEMS					
Domestic water usage per month	9,585,079 Gal/month	996,820 Gal/month	996,820 Gal/month	1,104,820 Gal/month	from bldg spread sheet
Domestic water system electrical usage (kwh)	387,853 kwh	40,336 kwh	34,395 kwh	41,184 kwh	from electrical spread sheet
Cost of electricity per year	$27,576	$2,868	$2,445	$2,928	@ $0.0743/kwh
Cost of Chlorination per year	$4,026	$419	$0	$464	@0 $0.035/1000 gal.
Demand Charge	$4,712	$4,712	$2,945	$4,712	@ $6.25/kw-month
Total Cost of Energy per Year	$36,314	$7,998	$5,390	$8,104	

Number of individual water wells = 10

**** option of leaving a valve open at each building to prevent pipes from freezing

UTILITY CONSUMPTION RATES FOR EXISTING BASE

BUILDING NUMBER	BUILDING DESCRIPTION	SQFT	SPACE CLASSIFICATION	SANITARY WASTE IN GAL/MONTH	DOMESTIC WATER IN GAL/MONTH
501	POST HEADQUARTERS	382	OFFICE	327	442
503	GYMNASIUM	27,430	GYM	12,344	16,664
504	FIRE STATION	6,192	FIRE STATION	5,307	7,165
510					
601	WAREHOUSE AND OFFICES	90,854	WAREHOUSE/OFF	54,512	73,592
602	GAS STATION		GAS STATION	15,000	20,250
603	POST ENGINEER	12,780	OFFICE	10,954	14,788
604	PLUMBING SHOP	27,344	MAINTENANCE	24,610	33,223
605	CONSOLIDATED PW	24,915	OFFICE	21,356	28,830
605A					
606	CENTRAL HEATING PLANT	30,334	MAINTENANCE	27,301	36,856
607	HEATING PLANT ANNEX	999	MAINTENANCE	899	1,214
608	CRTC MAINTENANCE	4,222	MAINTENANCE	3,800	5,130
609	CRTC HEADQUARTERS	3,530	OFFICE	3,026	4,085
610	CRTC PRODUCTION	5,120	OFFICE	4,389	5,925
612	CRTC MAINTENANCE AND A	18,681	MAINTENANCE	16,813	22,697
614	CRTC COMPUTERS		OFFICE		
615	MOTOR POOL	17,351	MAINTENANCE	15,616	21,081
617	POL OPERATION	448	MAINTENANCE	403	544
618	POL OPERATION	621	MAINTENANCE	559	755
625	WELL HOUSE #8	293	MAINTENANCE	264	356
626	AUTO CRAFT SHOP		MAINTENANCE		
627	MAS BOAT SHOP		MAINTENANCE		
628	NWTC BOAT SHOP		MAINTENANCE		
633	SEWAGE TREATMENT	2,784	MAINTENANCE	2,506	3,383
638	SEWAGE LAGOON	742	MAINTENANCE	668	902
639	CONTACT CHAMBER	696	MAINTENANCE	626	846
650	POST EXCHANGE	11,768	STORE	9,414	12,709
651	BOWLING LANES	12,600	BOWLING ALLEY	22,500	30,375
652	CLASSROOM	9,707	SCHOOL	14,561	19,657
653	NCO OPEN MESS	10,255	CAFETERIA	61,530	83,066
654		16,873			
656	AFFEES POST EXCHANGE	10,632	STORE	8,506	11,483
658	MAINTENANCE	25,425	MAINTENANCE	22,883	30,891
659	HQ COMPANY ATC	43,128	OFFICE	36,967	49,905
660	HQ AND HQ COMPANY USA	53,507	OFFICE	45,863	61,915
661	SPECIAL SERVICES	43,411	OFFICE	37,209	50,233
662	BARRACKS	46,754	BARRACKS/HSG	436,371	589,100
663	COMMISSARY	44,080	STORE	35,264	47,606
670	PUBLIC WORKS WAREHOUSE		WAREHOUSE		
675	LAUNDRY		LAUNDRY		
701	OFFICERS OPEN MESS	10,742	CAFETERIA	64,452	87,010
702	ARMY COMMUNITY SERVICE	16,625	OFFICE	14,250	19,238
705	HOUSING UNIT	6,015	BARRACKS/HSG	56,140	75,789
706	HOUSING UNIT	6,015	BARRACKS/HSG	56,140	75,789
707	HOUSING UNIT	6,015	BARRACKS/HSG	56,140	75,789
708	HOUSING UNIT	6,015	BARRACKS/HSG	56,140	75,789
709	HOUSING UNIT	6,015	BARRACKS/HSG	56,140	75,789
710	MECHANICAL ROOM		MAINTENANCE		
711	HOUSING UNIT		BARRACKS/HSG		
712	GARAGE		MAINTENANCE		
713					
714					
725	SCHOOL	54,604	SCHOOL	81,906	110,573
801	BILLETING	15,955	OFFICE	13,676	18,462
802	YOUTH ACTIVITIES		OFFICE		
804	BOQ	9,510	BARRACKS/HSG	88,760	119,826
805	BOQ	12,812	BARRACKS/HSG	119,579	161,431
806	BOQ	12,812	BARRACKS/HSG	119,579	161,431
808	HOUSING UNIT	12,812	BARRACKS/HSG	119,579	161,431
809	HOUSING UNIT	12,812	BARRACKS/HSG	119,579	161,431
810	HOUSING UNIT	12,812	BARRACKS/HSG	119,579	161,431
812		12,812	BARRACKS/HSG	119,579	161,431
813		12,812	BARRACKS/HSG	119,579	161,431
814	HOUSING UNIT	12,812	BARRACKS/HSG	119,579	161,431
816	HOUSING UNIT	12,812	BARRACKS/HSG	119,579	161,431
817	HOUSING UNIT	12,812	BARRACKS/HSG	119,579	161,431
818	HOUSING UNIT	12,812	BARRACKS/HSG	119,579	161,431
820	HOUSING UNIT	16,175	BARRACKS/HSG	150,967	203,805
821	HOUSING UNIT	16,175	BARRACKS/HSG	150,967	203,805
822	HOUSING UNIT	16,175	BARRACKS/HSG	150,967	203,805
823	MECHANICAL ROOM		MAINTENANCE		
825	HOUSING UNIT	13,466	BARRACKS/HSG	125,683	169,672
826	HOUSING UNIT	18,265	BARRACKS/HSG	170,473	230,139
827	HOUSING UNIT	18,265	BARRACKS/HSG	170,473	230,139
829	HOUSING UNIT	18,265	BARRACKS/HSG	170,473	230,139
830	HOUSING UNIT	18,265	BARRACKS/HSG	170,473	230,139
831	HOUSING UNIT	18,265	BARRACKS/HSG	170,473	230,139
833	HOUSING UNIT	18,265	BARRACKS/HSG	170,473	230,139
834	HOUSING UNIT	18,265	BARRACKS/HSG	170,473	230,139
835	HOUSING UNIT	18,265	BARRACKS/HSG	170,473	230,139

845	CHAPEL	11,737	CHURCH	117,370	158,450
847	CHILD DEVELOPMENT CENTER		CHILD CARE		
850	HOUSING UNIT	10,336	BARRACKS/HSG	96,469	130,234
851	HOUSING UNIT	10,336	BARRACKS/HSG	96,469	130,234
852	HOUSING UNIT	10,336	BARRACKS/HSG	96,469	130,234
853	MECHANICAL ROOM		MAINTENANCE		
854	HOUSING UNIT	13,466	BARRACKS/HSG	125,683	169,672
856	HOUSING UNIT	13,466	BARRACKS/HSG	125,683	169,672
857	MECHANICAL ROOM		MAINTENANCE		
862	HOUSING UNIT	14,459	BARRACKS/HSG	134,951	182,183
863	HOUSING UNIT	14,459	BARRACKS/HSG	134,951	182,183
864	HOUSING UNIT	14,459	BARRACKS/HSG	134,951	182,183
875	HOUSING UNIT	13,466	BARRACKS/HSG	125,683	169,672
876	HOUSING UNIT	13,466	BARRACKS/HSG	125,683	169,672
877	HOUSING UNIT	13,466	BARRACKS/HSG	125,683	169,672
878	MECHANICAL ROOM		MAINTENANCE		
887	HOUSING UNIT	13,466	BARRACKS/HSG	125,683	169,672
888	HOUSING UNIT	13,466	BARRACKS/HSG	125,683	169,672
889	HOUSING UNIT	13,466	BARRACKS/HSG	125,683	169,672
895	HOUSING UNIT	13,466	BARRACKS/HSG	125,683	169,672
896	HOUSING UNIT	13,466	BARRACKS/HSG	125,683	169,672
WASTE AND WATER FOR SEWARAGE TREATMENT				300,000	300,000
WASTE AND WATER FOR REFRIGATION SYSTEMS IN COMMISSARY				75,000	75,000
	TOTAL	1,311,194 sf		7,197,281	9,585,079

CLASSIFICATION	PEOPLE	WASTE USAGE	WASTE USAGE/SF/DAY
OFFICE	700 SF/PERSON	20 GAL/PERSON/DAY	0.03 GAL/SF/DAY
SCHOOL	500 SF/PERSON	25 GAL/PERSON/DAY	0.05 GAL/SF/DAY
GAS STATION	2 BAYS	1000 GAL/GAS BAY/DAY	500.00 GAL/DAY
BOWLING ALLEY	10 LANES	75 GAL/LANE/DAY	750.00 GAL/DAY
BARRACKS/HSG	225 SF/BED	70 GAL/BED/DAY	0.31 GAL/SF/DAY
STORE	750 SF/EMPLOYEE	20 GAL/PERSON/DAY	0.03 GAL/SF/DAY
LAUNDRY	100 WASH CYCLES/DAY	50 GAL/WASH CYCLE/DAY	5000.00 GAL/DAY
CAFETERIA	50 SF/PERSON	10 GAL/PERSON/DAY	0.20 GAL/SF/DAY
CHILD CARE	60 SF/PERSON	15 GAL/PERSON/DAY	0.25 GAL/SF/DAY
CHURCH	15 SF/PERSON	5 GAL/PERSON/DAY	0.33 GAL/SF/DAY
MAINTENANCE	0.03 GAL/SF/DAY	0.10 GAL/SF/DAY	0.03 GAL/SF/DAY
MAINT./OFF.	2000 SF/PERSON	20 GAL/PERSON/DAY	0.01 GAL/SF/DAY
WAREHOUSE	0.03 GAL/SF/DAY	0.10 GAL/SF/DAY	0.03 GAL/SF/DAY
WAREHOUSE/OFF	1000 SF/PERSON	20 GAL/PERSON/DAY	0.02 GAL/SF/DAY
FIRE STATION	700 SF/PERSON	20 GAL/PERSON/DAY	0.03 GAL/SF/DAY
UTILITY			
GYM	2000 SF/PERSON	30 GAL/PERSON/DAY	0.02 GAL/SF/DAY

UTILITY CONSUMPTION RATES FOR NEWLY CONFIGURED BASE

BUILDING NUMBER	BUILDING DESCRIPTION	SQFT	CLASSIFICATION	WASTE IN GAL/MONTH	WATER IN GAL/MONTH
501	HQ	19,095	OFFICE	16,367	22,096
503	GYM W/O POOL	27,430	GYM	12,344	16,664
504	FIRE STATION	6,195	FIRE STATION	5,310	7,169
605	CONSOLIDATED PW	24,915	OFFICE	21,356	28,830
606	CENTRAL HEATING PLANT	30,334	MAINTENANCE	27,301	36,856
607	HEX PLANT ANNEX	999	MAINTENANCE	899	1,214
612	TANK MAINTENANCE	18,681	MAINTENANCE	16,813	22,697
615	ROADS AND GROUNDS	17,351	MAINTENANCE	15,616	21,081
625	PUMP HOUSE	293	UTILITY		
633	SEWAGE TREATMENT	2,784	UTILITY	300,000	300,000
638	SEWAGE LAGOON	742	UTILITY		
639	CONTACT CHAMBER	696	UTILITY		
658	TEMP MOTOR POOL	25,425	MAINTENANCE	22,883	30,891
820	UNACC PERS HSG	16,175	BARRACKS/HSG	150,967	203,805
821	UNACC PERS HSG	16,175	BARRACKS/HSG	150,967	203,805
725	STATE SCHOOL	50228	SCHOOL	75,342	101,712
	TOTAL	257,518 sf		816,163	996,820

EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, CO 80227

DOMESTIC WATER SYSTEMS

BUILDING NUMBER	BUILDING DESCRIPTION	SQFT	CLASSIFICATION	WATER IN GAL/MONTH	COST OF CHLORINATION	MINIMUM FLOW RATE OF PUMP	WATER PUMP hp (@ 200 FT HEAD)	MINIMUM BLADDER TANK SIZE (GAL)
501	POST HQ	19,095	OFFICE	22,096	773 PER MONTH	20 GPM	5 HP	150
503	GYMNASIUM	27,430	GYM	16,664	583 PER MONTH	20 GPM	5 HP	120
504	FIRE STATION	6,192	FIRE STATION	7,165	251 PER MONTH	20 GPM	5 HP	100
605	CONSOLIDATED PW	24,915	OFFICE	28,830	1009 PER MONTH	20 GPM	5 HP	200
606	CENTRAL HEATING PLAN	31,333	UTILITY	0	0 PER MONTH	20 GPM	5 HP	100
612	TANK MAINTENANCE	18,681	MAINTENANCE	22,697	794 PER MONTH	20 GPM	5 HP	160
615	ROADS AND GROUNDS	17,351	MAINTENANCE	21,081	738 PER MONTH	20 GPM	5 HP	150
658	TEMP MOTOR POOL	25,425	MAINTENANCE	30,891	1081 PER MONTH	20 GPM	5 HP	210
725	SCHOOL	54,604	SCHOOL	110,573	3870 PER MONTH	20 GPM	5 HP	770
820	HOUSING UNIT	16,175	BARRACKS/HSG	203,805	7133 PER MONTH	20 GPM	5 HP	1,420
821	HOUSING UNIT	16,175	BARRACKS/HSG	203,805	7133 PER MONTH	20 GPM	5 HP	1,420
633	SEWAGE TREATMENT	2,784	UTILITY	300,000	10500 PER MONTH	N/A		
	TOTAL	260,160 sf		967,608				

DOMESTIC WATER SYSTEM COMPONENTS

1) WATER WELL DEPTH OF 400 FT +/- 60 FT
2) 400 FT DEEP +/- 60 FT OF 6"x0.375" WALL STEEL CASING
3) 50 FT OF 10" STAINLESS STEEL, ROD BASED SCREEN, EXTRA HEAVY DUTY, wELL PACKED WITH GRAVEL.
4) 1 STAGE, SUBMERSIBLE PUMP BOWL, MOTOR, #4/0 CABLE, 6" SURGE VALVE
5) 6" DISCHARGE ELBOW AND JUNCTION BOX
6) HYDRO-PNEUMATIC TANK, WITH FIXED BLADDER, FACTORY PRESSURIZED

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SANITARY WASTE SYSTEMS

BUILDING NUMBER	BUILDING DESCRIPTION	SQFT	CLASSIFICATION	WASTE IN GAL/MONTH	WASTE IN GAL/DAY	SEPTIC TANK SIZE	LENGTH OF SOIL ABSORPTION FIELD (LF) **
501	POST HQ	19,095	OFFICE	16,367	546	1,500 GAL	900 FT
503	GYMNASIUM	27,430	GYM	12,344	411	4,000 GAL	2,400 FT
504	FIRE STATION	6,192	FIRE STATION	5,307	177	750 GAL	450 FT
605	CONSOLIDATED PW	24,915	OFFICE	21,356	712	1,500 GAL	900 FT
606	CENTRAL HEATING PLAN	31,333	UTILITY	0	0	750 GAL	450 FT
612	TANK MAINTENANCE	18,681	MAINTENANCE	16,813	560	3,000 GAL	1,800 FT
615	ROADS AND GROUNDS	17,351	MAINTENANCE	15,616	521	3,000 GAL	1,800 FT
658	TEMP MOTOR POOL	25,425	MAINTENANCE	22,883	763	4,000 GAL	2,400 FT
725	SCHOOL	54,604	SCHOOL	81,906	2,730	4,000 GAL	2,400 FT
820	HOUSING UNIT	16,175	BARRACKS/HSG	150,967	5,032	5,000 GAL	3,000 FT
821	HOUSING UNIT	16,175	BARRACKS/HSG	150,967	5,032	5,000 GAL	3,000 FT
633	SEWAGE TREATMENT	2,784	UTILITY	300,000	10,000	N/A	N/A
	TOTAL	260,160 sf		794,524 GAL/MONTH	26,484 GAL/DAY		19,500 FT

SANITARY WASTE COMPONENTS

1) TWO COMPARTMENT SEPTIC TANK (SIZE VARIES PER BLDG).
2) DISTRIBUTION BOX
3) TWO LATERAL PERFORATED PIPES (LENGTHS VARY PER BLDG).
4) EXCAVATION FOR PERFORATED PIPES (TYPICAL CROSS SECTIONAL AREA OF TRENCH = 56^2 FT)
5) BACKFILL 12" BOTTOM OF TRENCH WITH GRAVEL
6) 4" DIAMETER PERFORATED PIPE IN 12" GRAVEL (LENGTH OF PIPE VARIES PER BLDG).
7) GEOTEXTILE FABRIC ABOVE 12" GRAVEL (LENGTH VARIES PER BLDG).
8) BACKFILL WITH SAND 24" UP FROM TOP OF 12" GRAVEL
9) BACKFILL WITH SELECT FILL FROM TOP OF SAND TO SURFACE (APPROX. 7 FT).

** ASSUMING CLAY SOIL WITH SMALL AMOUNTS OF SAND OR GRAVEL (120 SF OF LEACHING AREA FOR EVERY 100 GALS STORAGE)

EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, Co 80227

SUMMARY

#1406.003
Ft. Greely Utility Study
3/18/96
DGM

ELECTRICAL POWER USAGE FOR DOMESTIC WATER AND SANITARY WASTE SYSTEMS

Pump Efficency	0.65	
Motor efficiency	0.95	
head pressure conversion	55 psi	= 127 ft head

EXISTING

Pump Designation	Pump Horse power	Existing water usage	Head presure on pumps	Pump Flow Rate	Average Pump Usage	Electrical kw	Demand Charge	EXISTING Electrical usage/year	
domestic water pump #1	30	9585079 gal/month	127 ft head	608 gpm	37%	24 kw	$1,767 per year	75,335 kwh/yr	PUMPS ALTERNATE, THEREFORE
domestic water pump #2	30	alternates with #1	--	--	alternates with #1	--		--	ONLY INCLUDE ONE OF TWO PUMPS.
Well #8 water pump	50	9585079 gal/month	527 ft head	244 gpm	91%	39 kw	$2,945 per year	312,518 kwh/yr	PUMPS ALTERNATE, THEREFORE
Well #9 water pump	60	alternates with #1	--	--	alternates with #1	--		--	ONLY INCLUDE ONE OF TWO PUMPS.
Sanitary Waste Aration Pump	30	100% operation	--	--	100%	24 kw	$1,767 per year	206,367 kwh/yr	ONE PUMPS IN OPERATION 100% OF
Sanitary Waste Aration Pump	30	alternates with #1	--	--	alternates with #1	--		--	TIME - ALTERNATE
Sludge Pump	5	.2% operation	--	--	0.20%	4 kw	$294 per year	69 kwh/yr	
Effluent Pump #1	10	33% operation	--	--	33.00%	8 kw	$589 per year	22,700 kwh/yr	
Effluent Pump #2	10	33% operation	--	--	33.00%	8 kw	$589 per year	22,700 kwh/yr	
IMHOFF Exhaust Fan	2	0.6% operation	--	--	0.60%	2 kw	$118 per year	83 kwh/yr	

FUTURE

Pump Designation	Pump Horse power	Future water usage	Head presure on pumps	Pump Flow Rate	Average Pump Usage	Electrical Kw	Demand Charge	FUTURE Electrical usage/year	
domestic water pump #1	30	996820 gal/month	127 ft head	608 gpm	4%	24 kw	$1,767 per year	7,835 kwh/yr	PUMPS ALTERNATE, THEREFORE
domestic water pump #2	30	alternates with #1	--	--	alternates with #1	--		--	ONLY INCLUDE ONE OF TWO PUMPS.
domestic water pump #1 ***	30	1072420 gal/month	127 ft head	608 gpm	4%	24 kw	$1,767 per year	8,429 kwh/yr	PUMPS ALTERNATE, THEREFORE
domestic water pump #2 ***	30	alternates with #1	--	--	alternates with #1	--		--	ONLY INCLUDE ONE OF TWO PUMPS.
Well #8 water pump	50	996820 gal/month	527 ft head	244 gpm	9%	39 kw	$2,945 per year	32,501 kwh/yr	PUMPS ALTERNATE, THEREFORE
Well #9 water pump	60	alternates with #1	--	--	alternates with #1	--		--	ONLY INCLUDE ONE OF TWO PUMPS.
Sanitary Waste Aration Pump	30	100% operation	--	--	100%	24 kw	$1,767 per year	206,367 kwh/yr	ONE PUMPS IN OPERATION 100% OF
Sanitary Waste Aration Pump	30	alternates with #1	--	--	alternates with #1	--		--	TIME - ALTERNATE
Sludge Pump	5	.2% operation	--	--	0.20%	4 kw	$294 per year	69 kwh/yr	
Effluent Pump #1	10	33% operation	--	--	33.00%	8 kw	$589 per year	22,700 kwh/yr	
Effluent Pump #2	10	33% operation	--	--	33.00%	8 kw	$589 per year	22,700 kwh/yr	
IMHOFF Exhaust Fan	2	0.6% operation	--	--	0.60%	2 kw	$118 per year	83 kwh/yr	
Individual building well pump	5	10% operation	527 ft head	25 gpm	10%	4 kw	$294 per year	3,439 kwh/yr	PER PUMP REQUIRED

*** option of leaving open valve open at each bldg for freeze protection of pipe (0.25 gpm)

FREEZE PROTECTION BY WATER FLOW

Utilidor Temperature 1.0 temp

WILL DOM. WATER PIPE FREEZE? (WATER FLOWING)

PIPE LEG	PIPE SIZE	PIPE LENGTH	HEAT LOSS PER LINEAL FOOT (ASHRAE) (40F Delta T) ((btu/hr)/ft)	HEAT LOSS PER LINEAL FOOT (Adjusted) ((btu/hr)/ft)	WATER FLOW (gal/min)	WATER FLOW (Btu/hr/F)	HEAT LOSS (Btu/hr)	TEMPERATRE DROP (F)	CRITICAL PATH	FLUID TENPERATURE (F) 38.0	FREEZE?
Bldg 606 to Bldg 606 Manhole	8 in	10 ft	103.7	95.9	73.5	36,750	959	0.0	1	38.0	NO
Bldg 606 Manhole to Manhole 3E	6 in	1,300 ft	80.7	74.6	1.5	750	96,973	129.3		38.0	NO
Manhole 3E to Bldg 615 hydrant	6 in	100 ft	80.7	74.6	0.5	250	7,459	29.8		38.0	NO
Manhole 3E to Bldg 615	6 in	110 ft	80.7	74.6	1.0	500	8,205	16.4		38.0	NO
Bldg 606 Manhole to Manhole 9	8 in	220 ft	103.7	95.9	72.0	36,000	21,088	0.6	1	37.4	NO
Manhole 9 to Bldg 605	8 in	280 ft	103.7	94.3	0.5	250	26,414	105.7		37.4	NO
Manhole 9 to Manhole 12	8 in	540 ft	103.7	94.3	71.5	35,750	50,942	1.4	1	36.0	NO
Manhole 12 to Bldg 504	1 1/4in	190 ft	21.8	19.1	0.5	250	3,620	14.5		36.0	NO
Manhole 12 to Manhole 13	6 in	120 ft	80.7	70.5	71.0	35,500	8,465	0.2	1	35.7	NO
Manhole 13 to Bldg 503	1 1/4in	130 ft	21.8	18.9	0.5	250	2,460	9.8		35.7	NO
Manhole 13 to Manhole 13A	6 in	40 ft	80.7	70.1	70.5	35,250	2,802	0.1	1	35.6	NO
Manhole 13A to Bldg 503	4 in	130 ft	57.0	49.4	0.5	250	6,418	25.7		35.6	NO
Manhole 13A to Manhole 16	6 in	350 ft	80.7	69.9	70.0	35,000	24,464	0.7	1	34.9	NO
Manhole 16 to Bldg 501	2 1/2in	120 ft	38.3	32.5	0.5	250	3,900	15.6	-	34.9	NO
Manhole 16 to Manhole 63	6 in	640 ft	80.7	68.5	69.5	34,750	43,831	1.3	1	33.7	NO
Manhole 63 to Bldg 821 Manhole	6 in	190 ft	80.7	65.9	35.0	17,500	12,529	0.7	-	33.7	NO
Bldg 821 Manhole to Bldg 821	2 in	60 ft	31.8	26.0	0.5	250	1,559	6.2		33.7	NO
Manhole 63 to Manhole 40	6 in	100 ft	80.7	65.9	34.5	17,250	6,594	0.4	1	33.3	NO
Manhole 40 to Bldg 820	2 in	30 ft	31.8	25.7	0.5	250	770	3.1		33.3	NO
Manhole 40 to Manhole 43	6 in	360 ft	80.7	65.2	34.0	17,000	23,461	1.4	1	31.9	NO
Manhole 43 to Manhole 65	6 in	320 ft	80.7	62.4	21.0	10,500	19,964	1.9		31.9	NO
Manhole 65 to Bldg 725	3 in	190 ft	44.6	34.5	8.0	4,000	6,551	1.6		31.9	NO
Manhole 43 to Manhole 62	6 in	240 ft	80.7	62.4	13.0	6,500	14,973	2.3	1	29.6	NO
Manhole 62 to Bldg 725	2 1/2in	210 ft	38.3	27.4	13.0	6,500	5,755	0.9	1	28.7	NO
							400,158				

Required Flow Rate (gpm)	73.5		
Annual Water Consumption (gal)	19,315,800		
Annual Well Pump Electricity (kWh)	781,597	0.0405	kWh/gal
Annual Electric Cost ($)	16,489	0.000854	$/gal
Annual Chlorination Cost ($)	8,125	0.000421	$/gal
Annual Energy Consumption (MBtu)	967		
Annaul Fuel Oil Use (gal)	9,073		
Annaul Fuel Oil Cost ($)	6,623		

FREEZE PROTECTION BY WATER FLOW AND HEATING

Utilidor Temperature 1.0 temp

WILL DOM. WATER PIPE FREEZE? (WATER FLOWING)											
PIPE LEG	PIPE SIZE	PIPE LENGTH	HEAT LOSS PER LINEAL FOOT (ASHRAE) (40F Delta T) ((btu/hr)/ft)	HEAT LOSS PER LINEAL FOOT (Adjusted) ((btu/hr)/ft)	WATER FLOW (gal/min)	WATER FLOW (Btu/hr/F)	HEAT LOSS (Btu/hr)	TEMPERATRE DROP (F)	CRITICAL PATH	FLUID TENPERATURE (F) 60.0	FREEZE?
Bldg 606 to Bldg 606 Manhole	8 in	10 ft	103.7	153.0	31.5	15,750	1,530	0.1	1	59.9	NO
Bldg 606 Manhole to Manhole 3E	6 in	1,300 ft	80.7	118.8	1.5	750	154,488	206.0		59.9	NO
Manhole 3E to Bldg 615 hydrant	6 in	100 ft	80.7	118.8	0.5	250	11,884	47.5		59.9	NO
Manhole 3E to Bldg 615	6 in	110 ft	80.7	118.8	1.0	500	13,072	26.1		59.9	NO
Bldg 606 Manhole to Manhole 9	8 in	220 ft	103.7	152.7	30.0	15,000	33,595	2.2	1	57.7	NO
Manhole 9 to Bldg 605	8 in	280 ft	103.7	146.9	0.5	250	41,132	164.5		57.7	NO
Manhole 9 to Manhole 12	8 in	540 ft	103.7	146.9	29.5	14,750	79,326	5.4	1	52.3	NO
Manhole 12 to Bldg 504	1 1/4in	190 ft	21.8	28.0	0.5	250	5,311	21.2		52.3	NO
Manhole 12 to Manhole 13	6 in	120 ft	80.7	103.5	29.0	14,500	12,416	0.9	1	51.4	NO
Manhole 13 to Bldg 503	1 1/4in	130 ft	21.8	27.5	0.5	250	3,573	14.3		51.4	NO
Manhole 13 to Manhole 13A	6 in	40 ft	80.7	101.7	28.5	14,250	4,070	0.3	1	51.1	NO
Manhole 13A to Bldg 503	4 in	130 ft	57.0	71.5	0.5	250	9,289	37.2		51.1	NO
Manhole 13A to Manhole 16	6 in	350 ft	80.7	101.2	28.0	14,000	35,407	2.5	1	48.6	NO
Manhole 16 to Bldg 501	2 1/2in	120 ft	38.3	45.6	0.5	250	5,471	21.9	-	48.6	NO
Manhole 16 to Manhole 63	6 in	640 ft	80.7	96.1	27.5	13,750	61,479	4.5	1	44.1	NO
Manhole 63 to Bldg 821 Manhole	6 in	190 ft	80.7	87.0	14.0	7,000	16,538	2.4	-	44.1	NO
Bldg 821 Manhole to Bldg 821	2 in	60 ft	31.8	34.3	0.5	250	2,058	8.2		44.1	NO
Manhole 63 to Manhole 40	6 in	100 ft	80.7	87.0	13.5	6,750	8,704	1.3	1	42.9	NO
Manhole 40 to Bldg 820	2 in	30 ft	31.8	33.3	0.5	250	998	4.0		42.9	NO
Manhole 40 to Manhole 43	6 in	360 ft	80.7	84.4	13.0	6,500	30,398	4.7	1	38.2	NO
Manhole 43 to Manhole 65	6 in	320 ft	80.7	75.0	3.0	1,500	24,001	16.0		38.2	NO
Manhole 65 to Bldg 725	3 in	190 ft	44.6	41.5	3.0	1,500	7,876	5.3		38.2	NO
Manhole 43 to Manhole 62	6 in	240 ft	80.7	75.0	10.0	5,000	18,001	3.6	1	34.6	NO
Manhole 62 to Bldg 725	2 1/2in	210 ft	38.3	32.1	10.0	5,000	6,751	1.4	1	33.2	NO
							587,368				

Required Flow Rate (gpm)	31.5		
Annual Water Consumption (gal)	8,278,200		
Annual Well Pump Electricity (kWh)	334,970	0.0405	kWh/gal
Annual Electric Cost ($)	7,067	0.000854	$/gal
Annual Chlorination Cost ($)	3,482	0.000421	$/gal
Annual Energy Consumption (MBtu)	1,933		
Annaul Fuel Oil Use (gal)	18,146		
Annaul Fuel Oil Cost ($)	13,247		

FREEZE PROTECTION BY WATER FLOW, HEATING, & PIPE INSULATION

Utilidor Temperature 1.0 temp

WILL DOM. WATER PIPE FREEZE? (WATER FLOWING)												
PIPE LEG	PIPE SIZE	PIPE LENGTH	INSULATION THICKNESS (in)	HEAT LOSS PER LINEAL FOOT (Manville) (70F Delta T) ((btu/hr)/ft)	HEAT LOSS PER LINEAL FOOT (Adjusted) ((btu/hr)/ft)	WATER FLOW (gal/min)	WATER FLOW (Btu/hr/F)	HEAT LOSS (Btu/hr)	TEMPERATRE DROP (F)	CRITICAL PATH	FLUID TENPERATURE (F) 60.0	FREEZE?
Bldg 606 to Bldg 606 Manhole	8 in	10 ft	1.50	22.0	18.5	12.5	6,250	185	0.0	1	60.0	NO
Bldg 606 Manhole to Manhole 3E	6 in	1,300 ft	1.50	21.0	31.0	1.5	750	40,247	53.7		60.0	NO
Manhole 3E to Bldg 615 hydrant	6 in	100 ft	1.50	21.0	31.0	0.5	250	3,096	12.4		60.0	NO
Manhole 3E to Bldg 615	6 in	110 ft	1.50	21.0	31.0	1.0	500	3,406	6.8		60.0	NO
Bldg 606 Manhole to Manhole 9	8 in	220 ft	1.50	22.0	32.4	11.0	5,500	7,135	1.3	1	58.7	NO
Manhole 9 to Bldg 605	8 in	280 ft	1.50	22.0	31.7	0.5	250	8,882	35.5		58.7	NO
Manhole 9 to Manhole 12	8 in	540 ft	1.50	22.0	31.7	10.5	5,250	17,129	3.3	1	55.4	NO
Manhole 12 to Bldg 504	1 1/4in	190 ft	1.00	11.0	15.0	0.5	250	2,843	11.4		55.4	NO
Manhole 12 to Manhole 13	6 in	120 ft	1.50	21.0	28.6	10.0	5,000	3,428	0.7	1	54.7	NO
Manhole 13 to Bldg 503	1 1/4in	130 ft	1.00	11.0	14.8	0.5	250	1,921	7.7		54.7	NO
Manhole 13 to Manhole 13A	6 in	40 ft	1.50	21.0	28.2	9.5	4,750	1,128	0.2	1	54.5	NO
Manhole 13A to Bldg 503	4 in	130 ft	1.50	16.0	21.4	0.5	250	2,781	11.1		54.5	NO
Manhole 13A to Manhole 16	6 in	350 ft	1.50	21.0	28.1	9.0	4,500	9,828	2.2	1	52.3	NO
Manhole 16 to Bldg 501	2 1/2in	120 ft	1.50	13.0	16.7	0.5	250	2,001	8.0	-	52.3	NO
Manhole 16 to Manhole 63	6 in	640 ft	1.50	21.0	26.9	8.5	4,250	17,238	4.1	1	48.2	NO
Manhole 63 to Bldg 821 Manhole	6 in	190 ft	1.50	21.0	24.8	4.5	2,250	4,713	2.1	-	48.2	NO
Bldg 821 Manhole to Bldg 821	2 in	60 ft	1.50	10.0	11.8	0.5	250	709	2.8		48.2	NO
Manhole 63 to Manhole 40	6 in	100 ft	1.50	21.0	24.8	4.0	2,000	2,480	1.2	1	47.0	NO
Manhole 40 to Bldg 820	2 in	30 ft	1.50	10.0	11.5	0.5	250	345	1.4		47.0	NO
Manhole 40 to Manhole 43	6 in	360 ft	1.50	21.0	24.2	3.5	1,750	8,695	5.0	1	42.0	NO
Manhole 43 to Manhole 65	6 in	320 ft	1.50	21.0	21.5	1.5	750	6,894	9.2	-	42.0	NO
Manhole 65 to Bldg 725	3 in	190 ft	1.50	13.0	13.3	1.5	750	2,534	3.4		42.0	NO
Manhole 43 to Manhole 62	6 in	240 ft	1.50	21.0	21.5	2.0	1,000	5,171	5.2	1	36.9	NO
Manhole 62 to Bldg 725	2 1/2in	210 ft	1.50	13.0	11.7	2.0	1,000	2,448	2.4	1	34.4	NO
								155,238				

Required Flow Rate (gpm)	12.5		
Annual Water Consumption (gal)	3,285,000		
Annual Well Pump Electricity (kWh)	132,925	0.0405	kWh/gal
Annual Electric Cost ($)	2,804	0.000854	$/gal
Annual Chlorination Cost ($)	1,382	0.000421	$/gal
Annual Energy Consumption (MBtu)	767		
Annaul Fuel Oil Use (gal)	7,201		
Annaul Fuel Oil Cost ($)	5,257		

EMC Engineers, Inc
2750 S Wadsworth Blvd
Denver, CO 80227

EXCAVATION REQUIREMENTS FOR LEACH FIELD

BLDG	DESCRIPTION	LEACH FIELD LENGTH	TOTAL EXCAVATION	GRAVEL BACKFILL	SAND BACKFILL	SELECT BACKFILL
501	POST HQ	900 FT	55,440 FT^3	1,800 FT^3	2,700 FT^3	50,940 FT^3
503	GYMNASIUM	2,400 FT	147,840 FT^3	4,800 FT^3	7,200 FT^3	135,840 FT^3
504	FIRE STATION	450 FT	27,720 FT^3	900 FT^3	1,350 FT^3	25,470 FT^3
605	CONSOLIDATED PW	900 FT	55,440 FT^3	1,800 FT^3	2,700 FT^3	50,940 FT^3
606	CENTRAL HEATING PLAN	450 FT	27,720 FT^3	900 FT^3	1,350 FT^3	25,470 FT^3
612	TANK MAINTENANCE	1,800 FT	110,880 FT^3	3,600 FT^3	5,400 FT^3	101,880 FT^3
615	ROADS AND GROUNDS	1,800 FT	110,880 FT^3	3,600 FT^3	5,400 FT^3	101,880 FT^3
658	TEMP MOTOR POOL	2,400 FT	147,840 FT^3	4,800 FT^3	7,200 FT^3	135,840 FT^3
725	SCHOOL	2,400 FT	147,840 FT^3	4,800 FT^3	7,200 FT^3	135,840 FT^3
820	HOUSING UNIT	3,000 FT	184,800 FT^3	6,000 FT^3	9,000 FT^3	169,800 FT^3
821	HOUSING UNIT	3,000 FT	184,800 FT^3	6,000 FT^3	9,000 FT^3	169,800 FT^3
633	SEWAGE TREATMENT	N/A	N/A	N/A	N/A	N/A
	Total (FT^3)	19,500 FT	1,201,200 FT^3	39,000 FT^3	58,500 FT^3	1,103,700 FT^3
	Total (CY)		44,489 CY	1,444 CY	2,167 CY	40,878 CY

TOTAL EXCAVATION = LEACH FIELD LENGTH * (56 FT^2) * (1.1)
(1.1 = 10% FOR MISC.)

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Approach taken to achieve a calculatable flow rate for sanitary sewer and domestic water for bldg's at Fort Greely.

*sanitary sewer

- Where possible, for sewage, use U.P.C. Table I-3, page 260-261, for estimated waste flow rates for various bldgs (Private sewage disposal systems).

offices	– 20 gal/day/employee	at 80 S.F./person
schools	– 28 gal/day/student	at 20 S.F./person
gas station	– 1000 gal/day/gas bay	at 2 bays
Bowling alley	– 75 gal/day/lane	at 10 lanes
Barracks/ Housing	– 60 gal/day/bed	at 100 S.F/bed
stores	– 20 gal/day/employee	at 200 S.F./employee
Laundry	– 50 gal/day/wash	at (assume 12 washing machines with wash cycles every hr for 8 hours)
Cafeteria	– 10 gal/day/person	at 20 S.F./person
Child Care	– 15 gal/day/person	at 30 S.F./person
Church	– 5 gal/day/person	at 15 S.F./person
Maintenance areas	– 1 gal/S.F./day	(assuming 1 Water closet, 1 LAV per 1000 S.F.) (≈ 30 flushes/day at 7 gal/flush ≈ 4 gpm for 1 hr at 2 hrs/day ≈ 550 gal/day misc.)

office/maintenance – 20 gal/day/employee at 160 S.F./person

Warehouse – 0.25 gal/S.F./day

Fire Station – 20 gal/day/fireman at 120 S.F./person

☒ S.F./person from Ashrae Pocket Guide page 28-129, [illegible]

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Continued: Flow rates for sanitary sewer and domestic water

* domestic water

- From meter readings at the school, water use ≃ 30% greater than waste use

From meter readings for the overall site, water use ≃ 40% greater than waste use.

The values from the sanitary waste estimate increased by 35% for the water use.

Electrical Usages at Sewage Lagoon

1) Sludge pumps, operates ½ hr every 10-14 day
(5 Hp) ≈ 18 hrs every year ≈ 0.2%

2) effluent pumps, operates 6-8 hrs/day
(2@10HP) ≈ 2920 hrs every year each

3) Imhoff Exhaust Fan, operates 1 hr/week
(2Hp) ≈ 52 hrs every year

4) Aerator blowers, operates continuously (only one)
(2@30 Hp) ≈ 8760 hrs every year

TABLE I-2
Capacity of Septic Tanks*

Single Family Dwellings – Number of Bedrooms	Multiple Dwelling Units or Apartments – One Bedroom Each	Other Uses: Maximum Fixture Units Served per Table 7-3	Minimum Septic Tank Capacity in Gallons	(liters)
1 or 2		15	750	(2838)
3		20	1000	(3785)
4	2 units	25	1200	(4542)
5 or 6	3	33	1500	(5678)
	4	45	2000	(7570)
	5	55	2250	(8516)
	6	60	2500	(9463)
	7	70	2750	(10,409)
	8	80	3000	(11,355)
	9	90	3250	(12,301)
	10	100	3500	(13,248)

Extra bedroom, 150 gallons (568 liters) each.
Extra dwelling units over 10, 250 gallons (946 liters) each.
Extra fixture units over 100, 25 gallons (95 liters) per fixture unit.

*Note: Septic tank sizes in this table include sludge storage capacity and the connection of domestic food waste disposal units without further volume increase.

TABLE I-3
Estimated Waste/Sewage Flow Rates

Because of the many variables encountered, it is not possible to set absolute values for waste/sewage flow rates for all situations. The designer should evaluate each situation and, if figures in this table need modification, they should be made with the concurrence of the Administrative Authority.

Type of Occupancy — **Gallons (liters) Per Day**

1. Airports ..... 15 (56.8) per employee
   ..... 5 (18.9) per passenger
2. Auto washers ..... Check with equipment manufacturer
3. Bowling alleys (snack bar only) ..... 75 (283.9) per lane
4. Camps:
   - Campground with central comfort station ..... 35 (132.5) per person
   - with flush toilets, no showers ..... 25 (94.6) per person
   - Day camps (no meals served) ..... 15 (56.8) per person
   - Summer and seasonal ..... 50 (189.3) per person
5. Churches (Sanctuary) ..... 5 (18.9) per seat
   - with kitchen waste ..... 7 (26.5) per seat

Type of Occupancy — **Gallons (liters) Per Day**

6. Dance halls ..... 5 (18.9) per person
7. Factories
   - No showers ..... 25 (94.6) per employee
   - With showers ..... 35 (132.5) per employee
   - Cafeteria, add ..... 5 (18.9) per employee
8. Hospitals ..... 250 (946.3) per bed
   - Kitchen waste only ..... 25 (94.6) per bed
   - Laundry waste only ..... 40 (151.4) per bed
9. Hotels (no kitchen waste) ..... 60 (227.1) per bed (2 person)
10. Institutions (Resident) ..... 75 (283.9) per person
    - Nursing home ..... 125 (473.1) per person
    - Rest home ..... 125 (473.1) per person
11. Laundries, self-service
    - (minimum 10 hours per day) ..... 50 (189.3) per wash cycle
    - Commercial ..... Per manufacturer's specifications
12. Motel ..... 50 (189.3) per bed space
    - with kitchen ..... 60 (227.1) per bed space
13. Offices 20 (75.7) per employee
14. Parks, mobile homes ..... 250 (946.3) per space
    - picnic parks (toilets only) ..... 20 (75.7) per parking space
    - recreational vehicles –
      - without water hook-up ..... 75 (283.9) per space
      - with water and sewer hook-up ..... 100 (378.5) per space
15. Restaurants – cafeterias ..... 20 (75.7) per employee
    - toilet ..... 7 (26.5) per customer
    - kitchen waste ..... 6 (22.7) per meal
    - add for garbage disposal ..... 1 (3.8) per meal
    - add for cocktail lounge ..... 2 (7.6) per customer
    - kitchen waste –
      - disposable service ..... 2 (7.6) per meal
16. Schools – Staff and office ..... 20 (75.7) per person
    - Elementary students ..... 15 (56.8) per person
    - Intermediate and high ..... 20 (75.7) per student
      - with gym and showers, add ..... 5 (75.7) per student
      - with cafeteria, add ..... 3 (11.4) per student
    - Boarding, total waste ..... 100 (378.5) per person
17. Service station, toilets ..... 1000 (3785) for 1st bay
    ..... 500 (1892.5) for each additional bay
18. Stores ..... 20 (75.7) per employee
    - public restrooms, add ..... 1 per 10 sq. ft. (4.1/m^2) of floor space
19. Swimming pools, public ..... 10 (37.9) per person
20. Theaters, auditoriums ..... 5 (18.9) per seat
    - drive-in ..... 10 (37.9) per space

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Calculation of Electrical usage/yr for pump motors

Domestic water pump #1, 30 Hp, existing water usage = 9,001,803 gal/month
head on pump = 55psi = 127ft head, motor η = 95%, pump η = 65%

$$\text{Pump flow rate} = \frac{Hp * 3960 * \eta_{pump}}{127 ft} = 608 \text{ gpm}$$

$$\text{Average pump usage} = \frac{9001803 \text{ gal/month} \left(\frac{12 \text{ months}}{1 \text{ yr}}\right)}{608 \text{ gpm} \left(\frac{60 \text{ min}}{1 \text{ hr}}\right)\left(\frac{24 \text{ hr}}{1 \text{ day}}\right)\left(\frac{365 \text{ days}}{1 \text{ yr}}\right)}$$

$$= 33.8\%$$

$$\text{Electrical KW} = \frac{0.746 * Hp}{\eta_{motor}} = 23.6 \text{ KW}$$

Electrical usage per year (KWH)

$$23.6 \text{ KW} * 24 \text{ hr/day} * 365 \text{ days/year} * 33.8\%$$

$$= 69877 \text{ KWH/yr}$$

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Purpose: Estimate the electrical power usage from the existing and future domestic water systems.

Known: The existing domestic water system is comprised of two - 50 Hp pumps, pressurizing two - 20,000 gal storage tanks.
Existing water usage = 9,990,105 gal/month (on average)
Future water usage = 1,527,580 gal/month (calculated)

- determining flowrate of pumps: $Hp = \frac{Ft\text{-}head * gpm}{3960 * \eta_{pump}}$

assume - pressurizing tank to 80 psi
- efficiency of pump ≈ 65%

$$gpm = \frac{Hp * 3960 * \eta_{pump}}{Ft.\ head} = \frac{50Hp * 3960 * 0.65}{(80psi * 2.31 \frac{Ft\ head}{psi})}$$

$$= 696\ gpm \approx 700\ gpm = 30,240,000\ gal/month$$

$$\text{existing usage} = \frac{9,990,105\ gal/month}{30,240,000\ gal/month} = 0.33 \text{ or } 33\%$$

- Convert Hp of KW: (assuming a 95% efficient motor)

$$KW = \frac{0.746 * Hp}{0.95} = 39.3\ kw$$

- Existing power usage = $39.3KW * 24\ hr/day * 365\ day/yr * 0.33$

= **113,608 KWH**

- Future power usage ⇒ $\frac{\text{Future water usage}}{\text{Existing water usage}} = \frac{1,527,580\ gal/month}{9,990,105\ gal/month}$

$= 0.15$ or 15%

∴ Future power usage = Existing power usage * 0.15 = **17,040 KWH**

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Requirements For Fire Protection Systems:

1) Existing bldgs to remain do not have sprinkler systems or standpipe systems within.
   - assume bldgs to have occupancy Classification of Ordinary Hazard, Therefore Hose flow required to be 1,000 gpm for a 90 minute duration.

   Fire protection Storage tank minimum size
   = 1000 gpm * 90 min = 90,000 gal

(2) **Steel Septic Tanks**

The minimum wall thickness of any steel septic tank shall be No. 12 U.S. gauge (0.109) (2.8 mm) and each such tank shall be protected from corrosion, both externally and internally, by an approved bituminous coating or by other acceptable means.

(3) **Alternate Materials**

(i) Septic tanks constructed of alternate materials may be approved by the Administrative Authority when complying with approved applicable standards.

(ii) Wooden septic tanks are prohibited.

(n) **Prefabricated Septic Tanks**

(1) Manufactured or prefabricated septic tanks shall comply with all approved applicable standards and be approved by the Administrative Authority.

(2) independent laboratory tests and engineering calculations certifying the tank capacity and structural stability shall be provided as required by the Administrative Authority.

I 6 Disposal Fields

(a) Distribution lines shall be constructed of clay tile laid with open joints, perforated clay pipe, perforated bituminous fiber pipe, perforated high density polyethylene pipe, perforated ABS pipe perforated PVC pipe or other approved materials, provided that sufficient openings are available for distribution of the effluent into the trench area.

(b) Before placing filter material or drain lines in a prepared excavation, all smeared or compacted surfaces shall be removed from trenches by raking to a depth of one (1) inch (25 mm) and the loose material removed. Clean stone, gravel, slag, or similar filter material acceptable to the Administrative Authority, varying in size from three fourths (3/4) inch to two and one-half (2-1/2) inches (19 mm to 64 mm) shall be placed in the trench to the depth and grade required by this section. Drain pipe shall be placed on filter material in an approved manner. The drain lines shall then be covered with filter material to the minimum depth required by this section and this covered with untreated building paper, straw, or similar porous material to prevent closure of voids with earth backfill. No earth backfill shall be placed over the filter material cover until after inspection and acceptance.

Exception: Listed or approved plastic leaching chambers may be used in lieu of pipe and filter material. Chamber installations shall follow the rules for disposal fields, where applicable, and shall conform to manufacturer's installation instructions.

(c) A grade board staked in the trench to the depth of filter material shall be utilized when distribution line is constructed with drain tile or a flexible pipe material which will not maintain alignment without continuous support.

(d) When seepage pits are used in combination with disposal fields, the

filter material in the trenches shall terminate at least five (5) feet (1.5 m) from the pit excavation and the line extending from such points to the seepage pit shall be approved pipe with watertight joints.

(e) Where two (2) or more drain lines are installed, an approved distribution box of sufficient size to receive lateral lines shall be installed at the head of each disposal field. The inverts of all outlets shall be level and the invert of the inlet shall be at least one (1) inch (25.4 mm) above the outlets. Distribution boxes shall be designed to insure equal flow and shall be installed on a level concrete slab in natural or compacted soil.

Distribution boxes shall be coated on the inside with a bituminous coating or other approved method acceptable to the Administrative Authority.

(f) All laterals from a distribution box to the disposal field shall be approved pipe with watertight joints. Multiple disposal field laterals, wherever practicable, shall be of uniform length.

(g) Connections between a septic tank and a distribution box shall be laid with approved pipe with watertight joints on natural ground or compacted fill.

(h) When the quantity of sewage exceeds the amount that can be disposed in five hundred (500) lineal feet (152.4 m) of leach line, a dosing tank shall be used. Dosing tanks shall be equipped with an automatic siphon or pump which discharges the tank once every three (3) or four (4) hours. The tank shall have a capacity equal to sixty (60) to seventy-five (75) percent of the interior capacity of the pipe to be dosed at one time. Where the total length of pipe exceeds one thousand (1000) lineal feet (304.8 m), the dosing tank shall be provided with two (2) siphons or pumps dosing alternately and each serving one-half (1/2) of the leach field.

(i) Disposal fields shall be constructed as follows:

	Minimum	Maximum
Number of drain lines per field	1	–
Length of each line	–	100 ft. (30.5 m)
Bottom width of trench	18 in. (0.5 m)	36 in. (0.9 m)
Spacing of lines, center-to-center	6 ft. (1.8 m)	–
Depth of earth cover of lines [preferred –18 in (457.2 mm)]	12 in. (0.3 m)	–
Grade of lines	level	3 in./100 ft. (25 mm/m)
Filter material under drain lines	12 in. (0.3 m)	–
Filter material over drain lines	2 in. (50.8 mm)	–

Minimum spacing between trenches or leaching beds shall be four (4) feet (1.2 m) plus two (2) feet (0.6 m) for each additional foot (0.3 m) of depth in excess of one (1) foot (0.3 m) below the bottom of the drain line. Distribution drain lines in leaching beds shall not be more than six (6) feet (1.8 m) apart on centers and no part of the perimeter of the leaching bed shall be more than three (3) feet (0.9 m) from a distribution drain line. Disposal fields, trenches and leaching beds shall not be paved over or covered by concrete

(a) **Recommended Design Criteria.** Sewage disposal systems sized using the estimated waste/sewage flow rates should be calculated as follows:

(1) Waste/sewage flow, up to 1500 gallons/day (5677.5 L/day)
Flow x 1.5 = septic tank size

(2) Waste/sewage flow, over 1500 gallons/day (5677.5 L/day)
Flow x 0.75 + 1125 = septic tank size

(3) Secondary system shall be sized for total flow per 24 hours.

(b) Also see Section I 2 of this appendix.

TABLE I-4
Design Criteria of Five Typical Soils

Type of Soil	Required sq. ft. of leaching area/ 100 gals. (m^2/L)	Maximum absorption capacity in gals./sq. ft. of leaching area for a 24 hr. period (L/m^2)
Coarse sand or gravel	20 (0.005)	5.0 (203.7)
Fine sand	25 (0.006)	4.0 (162.9)
Sandy loam or sandy clay	40 (0.010)	2.5 (101.8)
Clay with considerable sand or gravel	90 (0.022)	1.1 (44.8)
Clay with small amount of sand or gravel	120 (0.030)	0.8 (32.6)

TABLE I-5

Required Square Feet of Leaching Area/100 gals Septic Tank Capacity (m^2/L)		Maximum Septic Tank Size Allowable Gallons	(liters)
20–25	(0.005–0.006)	7500	(28,387.5)
40	(0.010)	5000	(18,925.0)
90	(0.022)	3500	(13,247.5)
120	(0.030)	3000	(11,355.0)

TABLE II

SEPTIC TANK MINIMUM LIQUID CAPACITY

A. Determine the applicable wastewater useage rate (Q) in TABLE III of these Standards.

B. Calculate the minimum septic tank volume (V) as follows:

1. For Q equal to or less than 250 gal/day:

   V = 750 gallons

2. For Q greater than 250 gal/day but less than 351 gal/day:

   V = 1000 gallons

3. For Q greater than 351 gal/day but less than 501 gal/day:

   V = 1250 gallons

4. For Q greater than 501 gal/day but less than 1501 gal/day:

   V = 2.5 Q

5. For Q greater than 1501 gal/day:

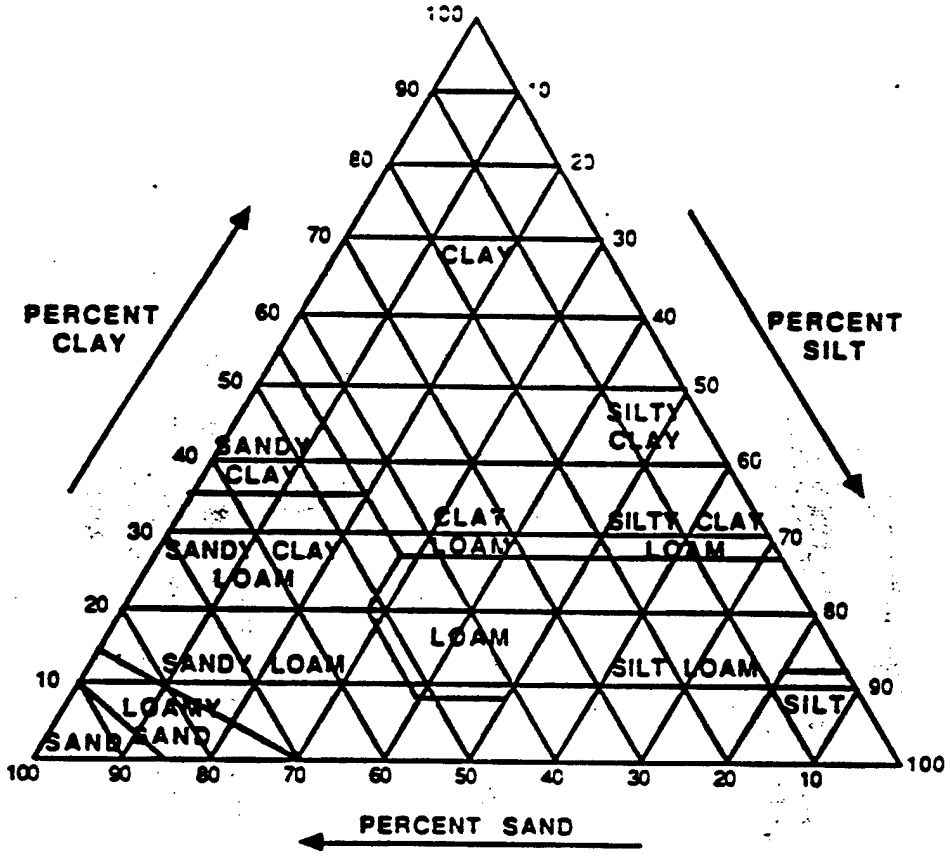
   V = 1,875 + 0.75 Q

NOTES: The inside liquid depth of the tank shall not be less than 30 inches.

Tank sizing in B (1)(2)(3) correspond to two, three and four bedroom single family dwellings.

TABLE VIII

USDA SOIL TEXTURAL CLASSIFICATIONS



Clay— Smaller than 0.002 millimeters in diameter

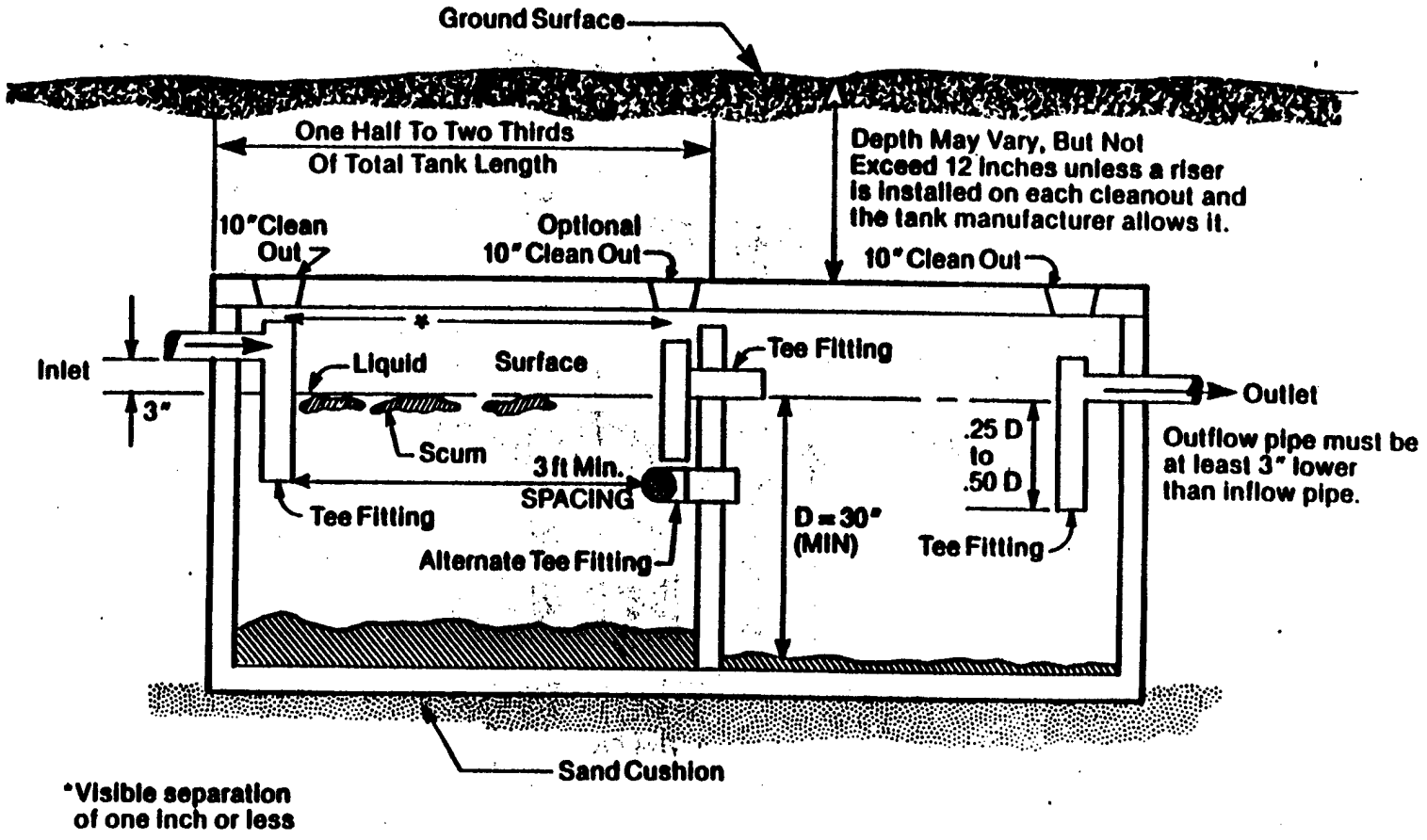
Silt — 0.05 to 0.002 millimeters in diameter

Sand — 2.0 to 0.05 millimeters in diameter

(Sand shall be free of organic matter and shall be composed of silica, quartz, mica or any other stable mineral).

FIGURE 1

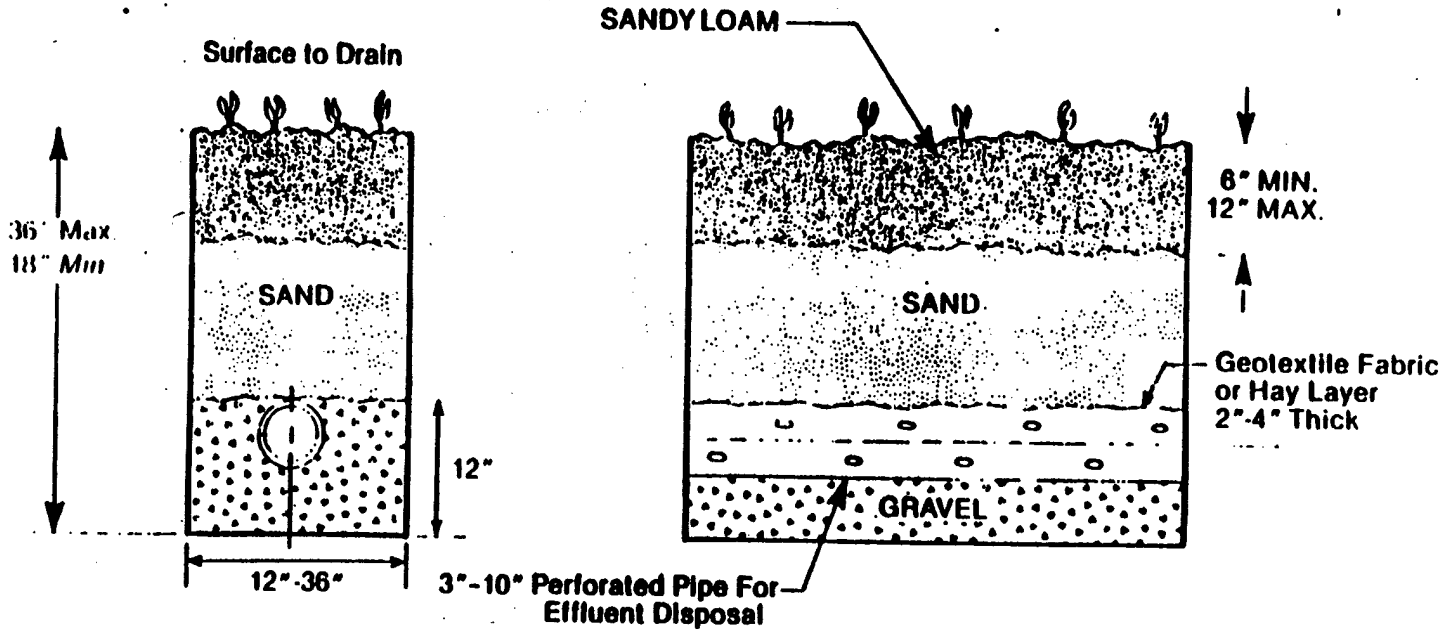
TWO COMPARTMENT SEPTIC TANK



Not intended to serve as an engineered design for construction purposes

FIGURE 3

SOIL ABSORPTION TRENCH



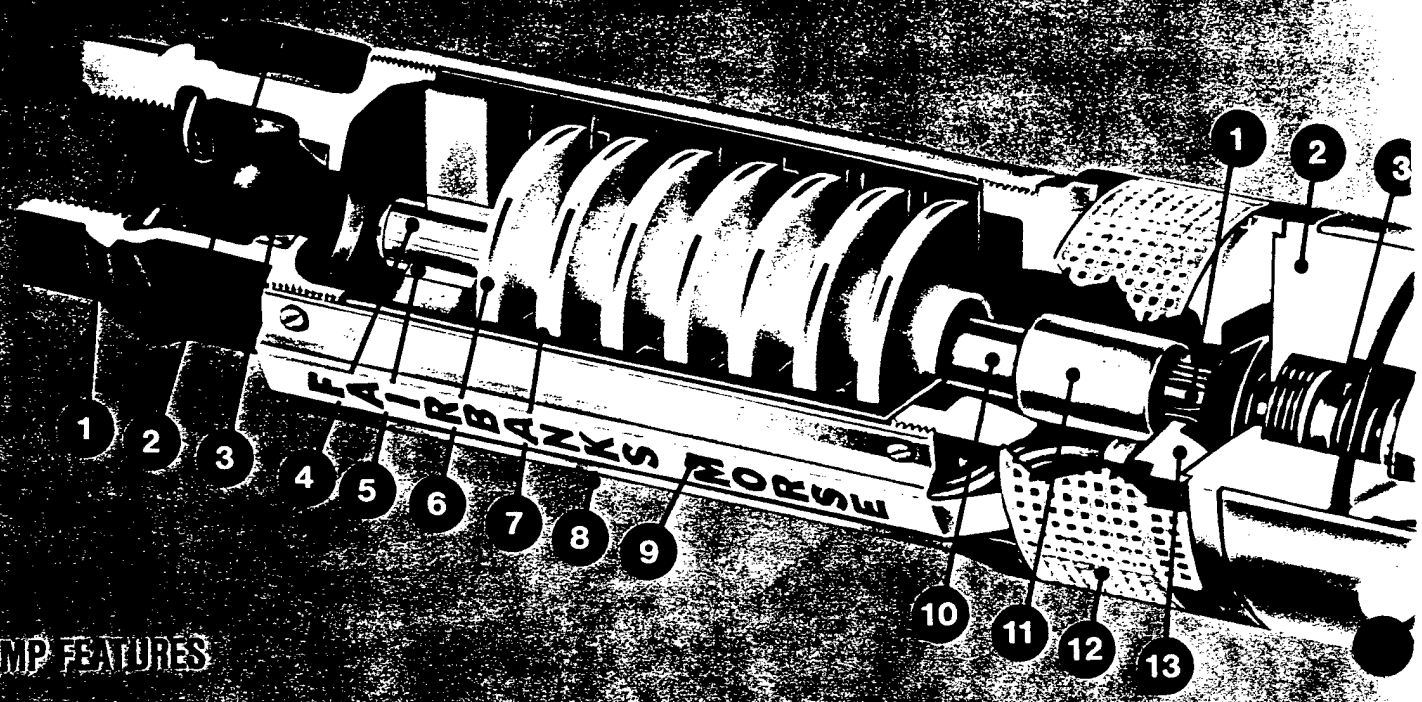
Not intended to serve as an engineered design for construction purposes.

Fairbanks Morse

Domestic Submersibles

Fairbanks Morse has an established history of pioneering products for increased customer satisfaction. Since 1830, this tradition has continued with each generation.

Our experienced pump people strive to serve the needs of society as it grows and changes. This product is an example of our commitment ... to be the best pump-motor builders in the world.



PUMP FEATURES

1. **HEX DISCHARGE HEAD**
Large wrenching surface allows installation ease. Open passage head design reduces friction losses normally associated with "in-the-head" bearing constructions.

2. **SAFETY ROPE HANDLE**
Large opening provides "in-the-well" pump unit security.

3. **BUILT-IN CHECK VALVE**
Infinite sealing surfaces of precision ground neoprene ball and angular contact bronze seat give the ultimate in proven dependability. Stainless steel retainer and non-mechanical design assure trouble-free service.

4. **SPLINED STAINLESS STEEL SHAFT**
Splines insure maximum drive contact within impeller hubs.

5. **UPPER SHAFT BEARING**
The stainless steel journal and the bronze bearing are part of a replaceable cartridge assembly (items 4-5-6-7-10-11) insuring proper alignment of the rotating components. Bearing spider design provides solid shaft support.

6. **IMPELLERS**
Celcon® construction provides inherent lubrication and ultra smooth finish for maximum flow and abrasive resistance. Extra heavy hubs provide exceptional strength at the shaft. ®Registered trademark—Celanese Plastics Co.

7. **DIFFUSER CASES**
Rugged Noryl® construction offers excellent abrasive resistance, high strength and built-in lubricity for maintaining "new pump" efficiency. Designed for optimum performance. ®Registered trademark—General Electric Co.

8. **POLISHED STAINLESS STEEL BODY**
Heavy wall type 304 stainless steel gives maximum protection against corrosive well conditions.

9. **STAINLESS STEEL LEAD GUARD**
Heavy duty construction protects motor leads from installation damage.

10. **THRUST BUSHING**
Stainless steel construction provides maximum strength.

11. **SPLINED STAINLESS STEEL COUPLING**
NEMA shaft coupling is pinned to pump shaft for precise fit and alignment. Design allows simplest pump-to-motor assembly available.

12. **CORROSION PROOF SUCTION SCREEN**
Special material provides maximum inlet flow by retarding water scale build-up.

13. **NEMA FLANGE MOUNTING BRACKET**
Standard mounting dimensions allow installation of any NEMA submersible motor. Large open design reduces suction restriction.

STAINLESS STEEL HARDWARE
All screws, nuts and washers are stainless steel, giving secure attachment of component parts.

TESTING
Every pump unit component goes through numerous inspections and tests prior to final assembly. Each pump unit assembly is water tested under multiple conditions simulating actual field applications as to pump performance and electrical power variations.

MOTOR FEATURES

1. **STAINLESS STEEL MOTOR SHAFT EXTENSION**
Spline drive complies with NEMA standards.

2. **NEMA FLANGE—THRUST CARRIER**
Fully submersible pump mounting NEMA standards. Large heavy duty thrust carrier housing takes all pump thrust loads. Other motor parts are not subjected to these loads. Permits precise mechanical seal and bearing placement.

3. **SHAFT SEAL**
Mechanical seal construction eliminates fluid transfer. Ceramic and carbon components are lapped and micro-polished to insure leakproof design.

4. **THRUST BEARING**
Ball construction provides smooth running, precise alignment and quiet operation. Large oil reserve provides permanent lubrication.

5. **5 YEAR INSULATION**
Electrical integrity is insured by this additional protection.

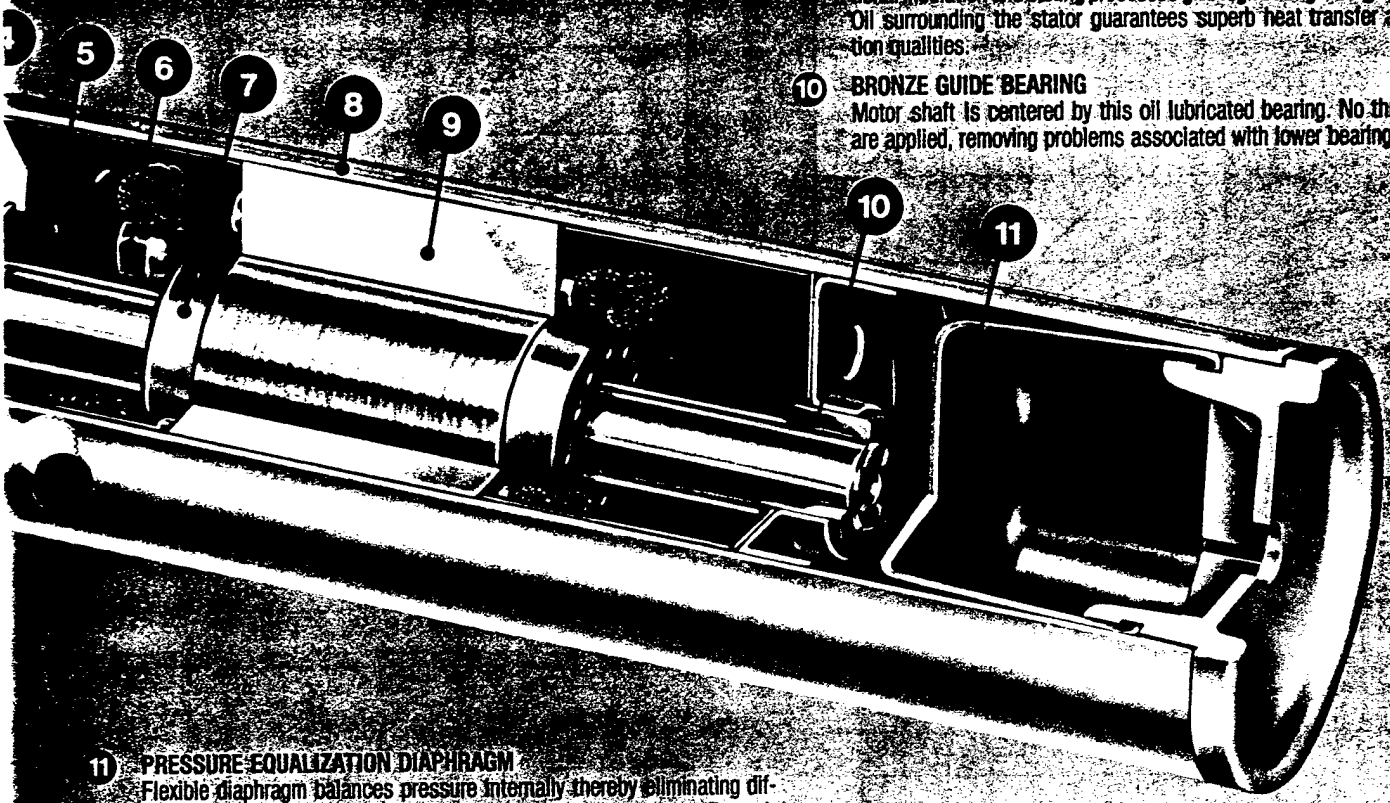
6. **BUILT-IN OVERLOAD PROTECTION—**
¾ HP 3-WIRE, 2-1½ HP 2-WIRE
Assures optimum motor protection from overload or voltage variation. Automatically resets for continued operation.

7. **ROTOR ASSEMBLY**
Precision die casting techniques, dynamic balancing and positive shaft straightness provide smooth operation and excellent starting torque. Tight control of rotor lamination skew assures electrical balance.

8. **POLISHED STAINLESS STEEL BODY**
Heavy wall type 304 stainless steel construction for maximum motor protection in corrosive well conditions.

9. **STATOR WINDINGS**
Automatic winding equipment eliminates human error, giving each motor exacting performance. Heavily insulated copper wire combined with additional insulation and baking processes give high strength surge protection. Oil surrounding the stator guarantees superb heat transfer and insulation qualities.

10. **BRONZE GUIDE BEARING**
Motor shaft is centered by this oil lubricated bearing. No thrust loads are applied, removing problems associated with lower bearing carriers.



11. **PRESSURE EQUALIZATION DIAPHRAGM**
Flexible diaphragm balances pressure internally thereby eliminating differential pressure across rotating seal between oil and well water. Regardless of submergence depth or motor temperature, no fluid transfer will occur.

OIL LUBRICATION AND COOLING
Highly refined dielectric mineral oil is approved for submersible motor application. Automatic vacuum process equipment insures complete oil-fill and eliminates air entrapment. Internal parts are not subject to corrosion or water scaling. Advanced design of oil-filled motor offers excellent insulation, superb heat transfer, elimination of hot spots and contaminant-free bearing lubrication.

TESTING

Every Fairbanks Morse submersible motor must meet high manufacturing acceptance levels. The latest in advanced electronic test equipment assures the highest quality submersible motors available.

Test stations placed at intermediate stages of assembly monitor the complete manufacturing process. High voltage surge test equipment automatically performs multiple stator integrity checks. Insulation of main and start windings must pass tests at progressive stages of assembly.

Performance testing of horsepower, speed, torque, amps, watts, volts and winding resistance is done after final assembly in addition to tests of rotation, vibration, noise and motor frame straightness.

MOTOR AND CONTROL TYPES

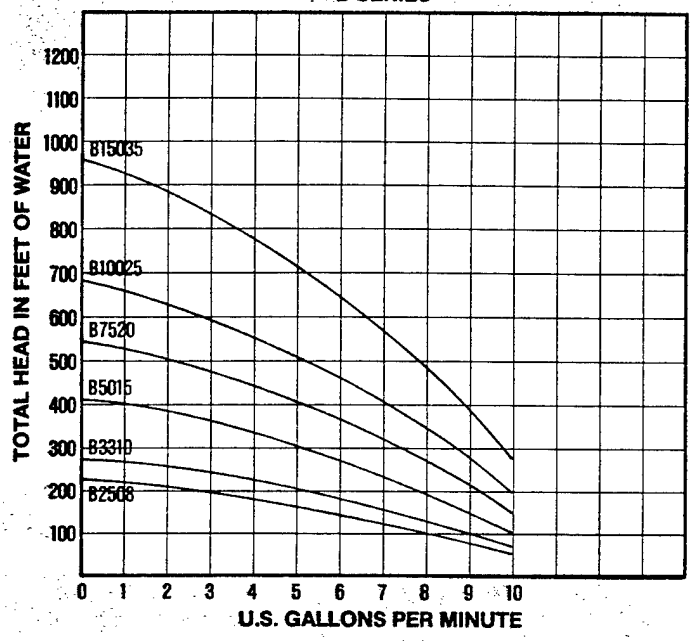
TWO-WIRE, 230 VOLT, SINGLE PHASE—
BUILT-IN START AND RUN CAPACITOR
Oil-filled, over-sized, 370 volt permanent split capacitor design eliminates troublesome in-the-motor switches associated with other two-wire units. Interchangeable leads that cannot be confused and no control box to install provide installation ease. Electrically efficient two-wire units have high running torque and proven in-the-well reliability.

THREE-WIRE, 115/230 VOLT, SINGLE PHASE—
ABOVE GROUND CONTROL BOX
Large box terminal for each wire assures easy installation and inspection. A removable circuit board and accessible components facilitate service. Conveniently located conduit knockouts and easy-to-read wiring diagram further simplify installation. 1½ HP and larger boxes include manual reset overload protection. Reset button is accessible without removing box cover. High torque three-wire motors offer time tested dependability where tough well conditions exist.

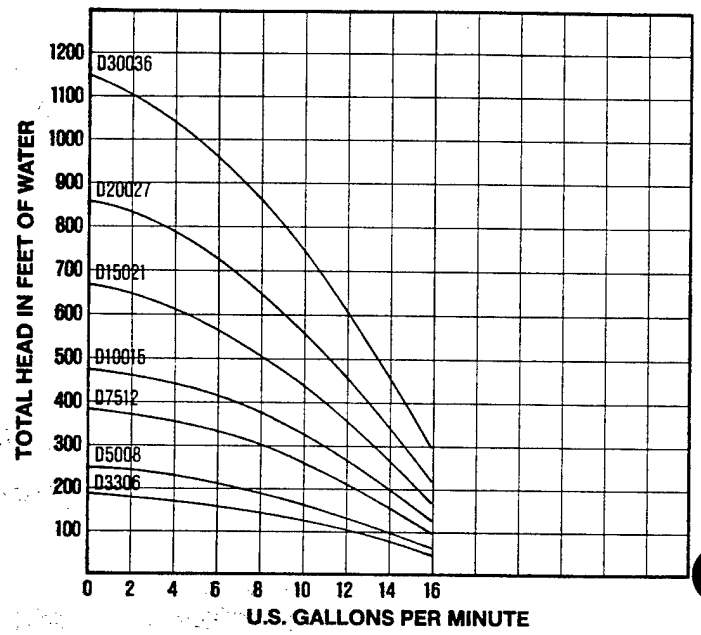
THREE PHASE, 230/460 VOLT—ABOVE GROUND MAGNETIC STARTER
Magnetic, three phase, non-reversing starters with ambient compensated quick trip overloads across each line are required for motor protection. Three phase submersible motors are high-torque, high-efficiency units for use where three phase power is available.

PUMP UNITS ARE TESTED AND RATED IN ACCORDANCE WITH WATER SYSTEM COUNCIL STANDARDS

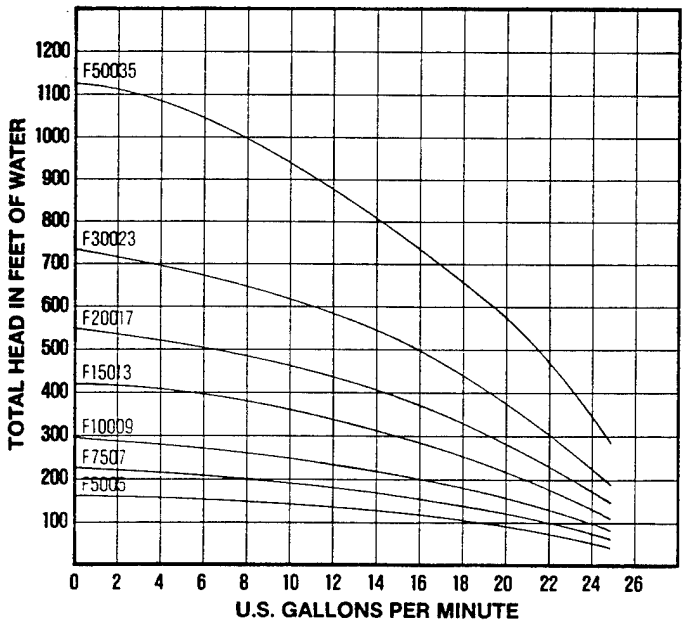
B SERIES



D SERIES



F SERIES



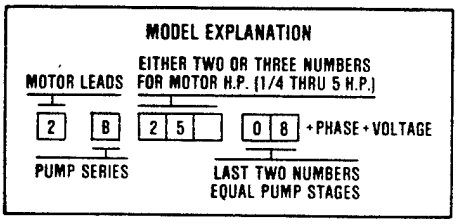
FAIRBANKS MORSE
4" DOMESTIC SUBMERSIBLE PUMP

NOMINAL CAPACITY

B SERIES	5 GPM
D SERIES	10 GPM
F SERIES	18 GPM

ORDERING INFORMATION

MODEL EXPLANATION



Selection Charts 3 & 5 H.P.

3 HP D30036

DEPTH TO WATER IN FEET*	18 GPM 36 STAGES	TANK PRESSURE (PSI) 0	20	30	40	50	60	SHUT-OFF (PSI)
	20					1059	1045	486
	40					1047	1033	477
	60				1049	1035	1021	468
	80			1050	1037	1023	1009	460
	100		1052	1039	1025	1011	996	451
	120		1040	1027	1013	998	984	442
	140	1056	1028	1014	1000	986	971	434
	160	1044	1016	1002	988	973	958	425
	180	1032	1004	990	975	960	946	416
	200	1020	991	977	962	947	932	408
	220	1007	979	964	950	934	919	399
	240	995	966	951	936	921	906	390
	260	983	953	938	923	908	892	382
	280	970	940	925	910	894	878	373
	300	957	927	912	896	880	864	364
	340	931	900	885	868	852	836	347
	380	904	873	857	840	823	806	330
	420	877	844	828	811	794	776	313
	460	849	815	798	781	763	745	295
	500	820	785	768	750	731	712	278
	540	790	754	736	717	698	678	261
	580	759	722	703	684	664	643	243
	620	727	689	669	648	628	606	226
	660	694	654	633	612	590	568	209
	700	659	618	596	573	550	526	191
	740	623	579	556	533	508	483	174
	780	585	539	515	490	463	436	157
	820	545	496	470	443	415	385	139
	860	503	450	422	393	361	328	122
	900	457	400	370	337	302	264	105
	940	408	346	311	274	233	187	87
	980	354	284	244	200	149	87	70
	1020	294	212	163	104			53
	1060	224	121					35
	1100	136						18

TOTAL SHUT-OFF HEAD 1141 FEET (494 PSI)

3 HP F30023

DEPTH TO WATER IN FEET*	18 GPM 23 STAGES	TANK PRESSURE (PSI) 0	20	30	40	50	60	SHUT-OFF (PSI)
	20					1539	1510	301
	40				1542	1515	1486	292
	60			1545	1518	1491	1448	283
	80		1548	1521	1494	1467	1434	275
	100		1527	1497	1470	1437	1411	266
	120	1554	1503	1473	1443	1413	1384	258
	140	1533	1479	1446	1419	1401	1355	249
	160	1509	1449	1422	1392	1359	1326	240
	180	1485	1425	1395	1365	1332	1296	232
	200	1458	1401	1371	1335	1302	1266	223
	220	1431	1374	1341	1305	1272	1236	214
	240	1407	1347	1311	1275	1242	1205	206
	260	1383	1317	1281	1245	1212	1171	197
	280	1353	1287	1251	1215	1179	1138	188
	300	1323	1257	1221	1182	1143	1098	180
	340	1263	1194	1155	1113	1065	1018	162
	380	1203	1125	1077	1032	978	922	145
	420	1134	1044	993	939	882	814	128
	460	1056	951	894	834	765	682	110
	500	966	852	783	708	624	525	93
	540	870	729	645	552	444	306	76
	580	750	579	477	354	204		58
	620	603	390	246				41
	660	420	96					24

TOTAL SHUT-OFF HEAD 730 FEET (316 PSI)

5 HP F50035

DEPTH TO WATER IN FEET*	18 GPM 35 STAGES	TANK PRESSURE (PSI) 0	20	30	40	50	60	SHUT-OFF (PSI)
	20						1571	465
	40					1572	1555	457
	60				1575	1560	1541	448
	80			1578	1560	1545	1528	439
	100		1581	1563	1548	1530	1510	431
	120		1566	1548	1530	1512	1494	422
	140	1584	1551	1533	1515	1497	1479	413
	160	1569	1536	1518	1500	1482	1462	405
	180	1554	1521	1503	1479	1464	1445	396
	200	1539	1506	1485	1467	1449	1428	387
	220	1527	1488	1470	1452	1431	1411	379
	240	1509	1473	1455	1434	1413	1393	370
	260	1494	1455	1437	1416	1398	1375	361
	280	1479	1440	1419	1401	1377	1357	353
	300	1461	1422	1401	1380	1362	1338	344
	340	1425	1386	1365	1344	1323	1300	327
	380	1392	1350	1329	1308	1284	1260	310
	420	1356	1314	1290	1266	1242	1216	292
	460	1317	1272	1248	1224	1197	1171	275
	500	1278	1230	1206	1179	1155	1127	258
	540	1239	1185	1161	1137	1110	1076	240
	580	1191	1143	1116	1086	1056	1026	223
	620	1149	1092	1065	1035	1002	966	206
	660	1101	1044	1011	978	942	905	188
	700	1050	984	951	915	879	834	171
	740	993	924	888	849	804	751	154
	780	933	861	816	768	717	662	136
	820	870	783	732	678	621	558	119
	860	795	693	639	576	510	432	102
	900	708	594	528	453	375	276	84
	940	606	474	396	303	207	84	67
	980	492	330	237	129			50
	1020	357	156					32
	1060	186						15

TOTAL SHUT-OFF HEAD 1120 FEET (484 PSI)

***Ratings are in Gallons Per Hour**

Friction losses in discharge pipe and fittings are not included in these tables.

SUBMERSIBLE WIRE SELECTION CHARTS

TABLE 1

	Volts	H.P.	Maximum Length DROP CABLE in Feet—Motor to Control Box or Starter: Wire Size (copper) #14	#12	#10	#8	#6	#4	#2	#0	H.P.	Maximum SUPPLY WIRE Length in Feet—Control Box or Starter to Load Center or Transformer: Wire Size (copper) #14	#12	#10	#8	#6	#4	#2	#0
Single Phase	115	¼	115	175	280						¼	30	45	70	115	175	285	455	
		1/3	110	165	260	371					1/3	25	40	65	105	165	260	415	
		½	80	130	195	310	471				½	20	30	60	80	125	200	315	500
	230	¼	450	705							¼	115	175	280	460	720			
		1/3	410	620	975						1/3	100	165	260	415	650	1050		
		½	315	490	775	1230					½	75	120	195	310	490	775		
		¾	280	450	705	1120	1780				¾	70	110	175	280	445	710	1125	
		1	200	310	495	790	1260				1	50	80	125	200	315	500	795	1260
		1½	190	300	480	765	1210	1930			1½	50	75	120	190	305	485	770	1220
		2	185	290	465	740	1175	1865			2	45	75	115	185	295	465	745	1180
		3		210	335	535	850	1350	2150		3		55	85	135	210	340	535	855
		5			125	195	315	500	790	1250	5			30	50	80	125	200	310
Three Phase	230	1½	385	605	950						1½	85	135	210	325	490	740		
		2	305	480	755	1170					2	70	105	165	255	390	590		
		3	240	375	590	910					3	50	80	130	200	305	460	695	
		5	160	250	390	605	920	1390			5		55	85	135	200	305	460	665
	460	5	630	995	1560						5	140	220	345	530	810			

Use of cables smaller than recommended above will void warranty.

On single phase power supplies, line voltage at control box must not be less than 105 volts on 115 volt single-phase power supply or 210 volts on 230 volt single-phase power supply or 195 volts on 208 volt power supply while motor is running. Line voltage at magnetic starter must not be less than 215 volts on 230 volt 3-phase power supply.

The use of phase converters or starting controls, other than those furnished with the pump, or the substitution of overload heaters, voids the motor warranty.

Cable sizes and lengths are maximum allowable. Higher operating efficiency will be obtained by using next larger cable where lengths approach listed limits.

If a 208V motor is used, not more than 90% of the maximum cable length shown for 230V motors can be used.

WESFLEX SUPERTANKS

Hydro-pneumatic Well and Water System Tanks with Replaceable and Fixed Bladders

SINCE 1908
wessels company

Headquarters & Factory
1901 Marston Ave.
Detroit, MI 48211
(313) 875-5000
Fax: (313) 875-5004

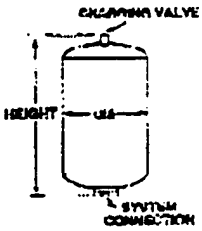
West Coast Office & Warehouse
1900 D Petra Lane
Placentia, CA 92870
(714) 524-0744
Fax (714) 524-0344

TYPE FXA WATER TANKS

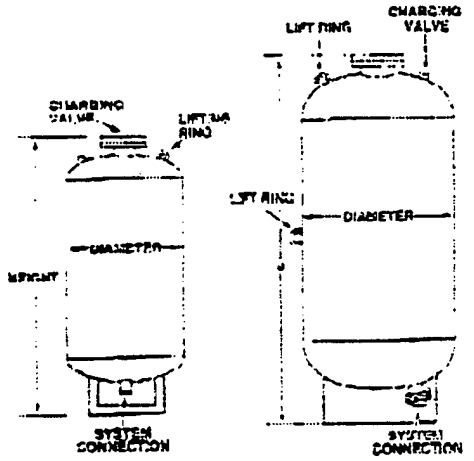
ASME replaceable bladder type water system tanks for commercial, industrial and municipal well water and booster applications sizes 10 to 3053 gallons.

Type FXA water system control tanks are designed for jobs that require high pressure centralized water storage for community wells, high-rise buildings, irrigation systems, and pressure boosting applications where the ultimate in performance and quality is required. Hefty drawdown prevents pumps from over cycling and allows saving of electrical energy by reducing frequent pump starts. Assists the pump in meeting peak demands. Models available up to 250 PSIG and higher working pressures. Efficient design allows use of smaller sizes to save on space and installation costs.

- ASME section VIII construction
- Permanent separation of air and water over the life of the system
- Water is "in the bag." Steel tank never touches water and is not subject to corrosion.
- Never water logs, no "red water"
- Replaceable bladder
- Standard pressures 125 PSI, 200 PSI and 250 PSI
- Can be manifolded for additional capacity
- Factory pre-charged and field adjustable



FXA 35 thru FXA 50



FXA 65 thru FXA 800 FXA 1000 thru FXA 15000

Model Number	Tank & Acceptance Vol. (gals.)	Dimensions Diameter (in)	Dimensions Height (in)	NPT System Connection	NPT System Connection	Shipping Weight Pounds
FXA 35	10	12	25	3/4"	–	40
FXA 50	13	14	25	3/4"	–	50
FXA 85	23	16	37	1"	1/2"	95
FXA 130	35	20	37	1"	1/2"	120
FXA 200	53	24	43	1 1/2"	1/2"	210
FXA 300	79	24	55	1 1/2"	3/4"	225
FXA 400	106	30	49	1 1/2"	3/4"	300
FXA 500	132	30	57	2"	3/4"	330
FXA 600	158	30	67	2"	3/4"	360
FXA 700	185	30	80	2"	–	600
FXA 800	211	36	63	2"	3/4"	475
FXA 1000	264	36	87	3"	–	730
FXA 1200	317	36	98	3"	–	745
FXA 1400	370	36	111	3"	–	900
FXA 1600	422	48	94	3"	–	1210
FXA 2000	526	48	97	3"	–	1300
FXA 2600	660	48	114	4"	–	1430
FXA 3000	792	48	134	4"	–	1575
FXA 3000S	792	60	93	4"	–	2109
FXA 4000	1056	60	115	4"	–	2058
FXA 5000	1320	60	138	4"	–	3246
FXA 7500	1980	72	140	4"	–	4080
FXA 10000	2640	72	172	4"	–	4920
FXA 15000	3963	72	243	4"	–	6000

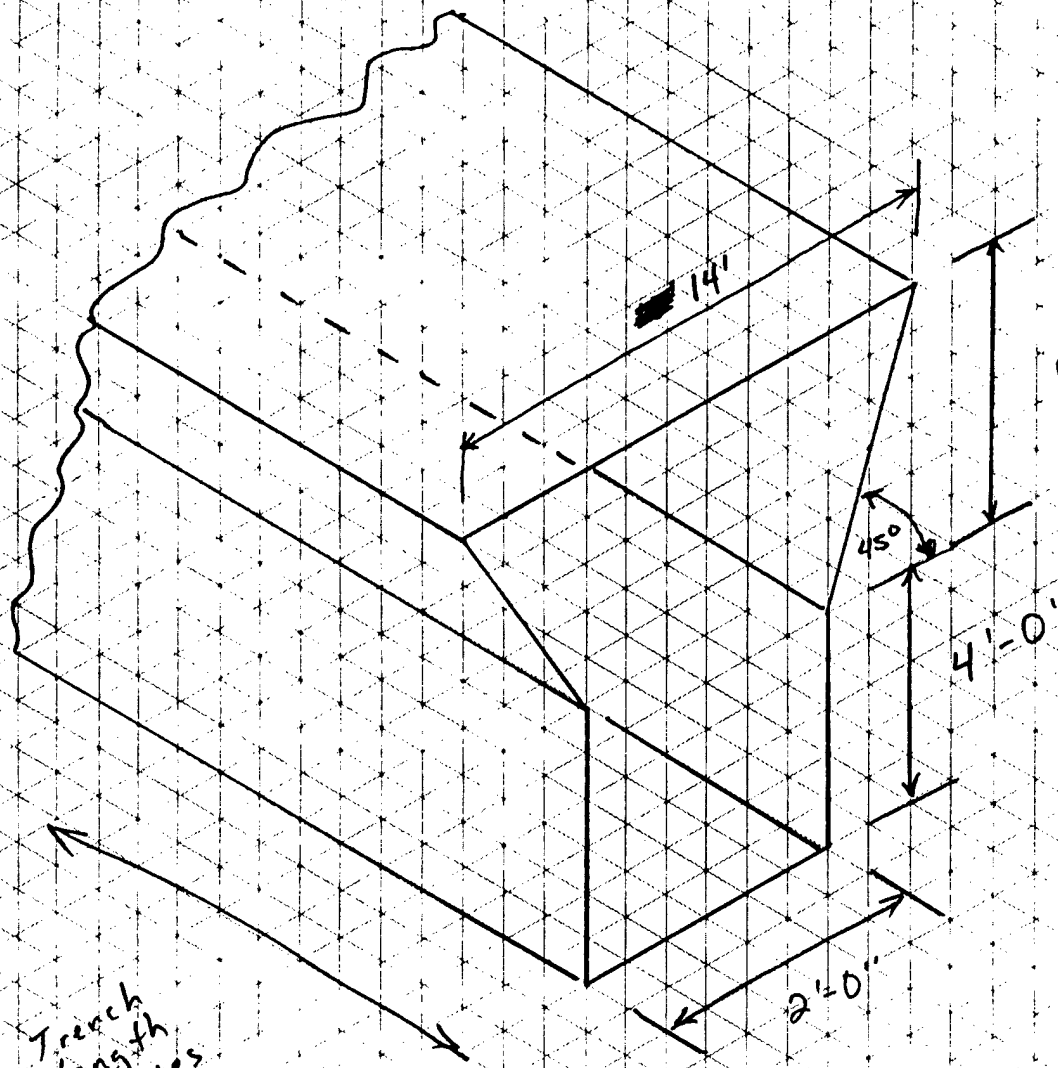
125°F maximum temperature - Factory pre-charge 50 PSI. Prime painted exterior finish

TYPICAL SPECIFICATIONS

Furnish and install as shown on plans a _____ gallon _____" diameter X _____" (high) pre-charged steel hydro-pneumatic tank with replaceable heavy duty butyl rubber bladder. The tank shall have NPT system connections and a .302" - 32 charging valve connection (standard tire valve) to facilitate the on site charging of the tank to meet system requirements. The tank must be constructed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code.

Each tank shall be Wessels model number FXA _____ or approved equal.

Fort Greely
Utility Study
1406.003
12-8-95
D G M



Excavation requirements
For soil absorption field

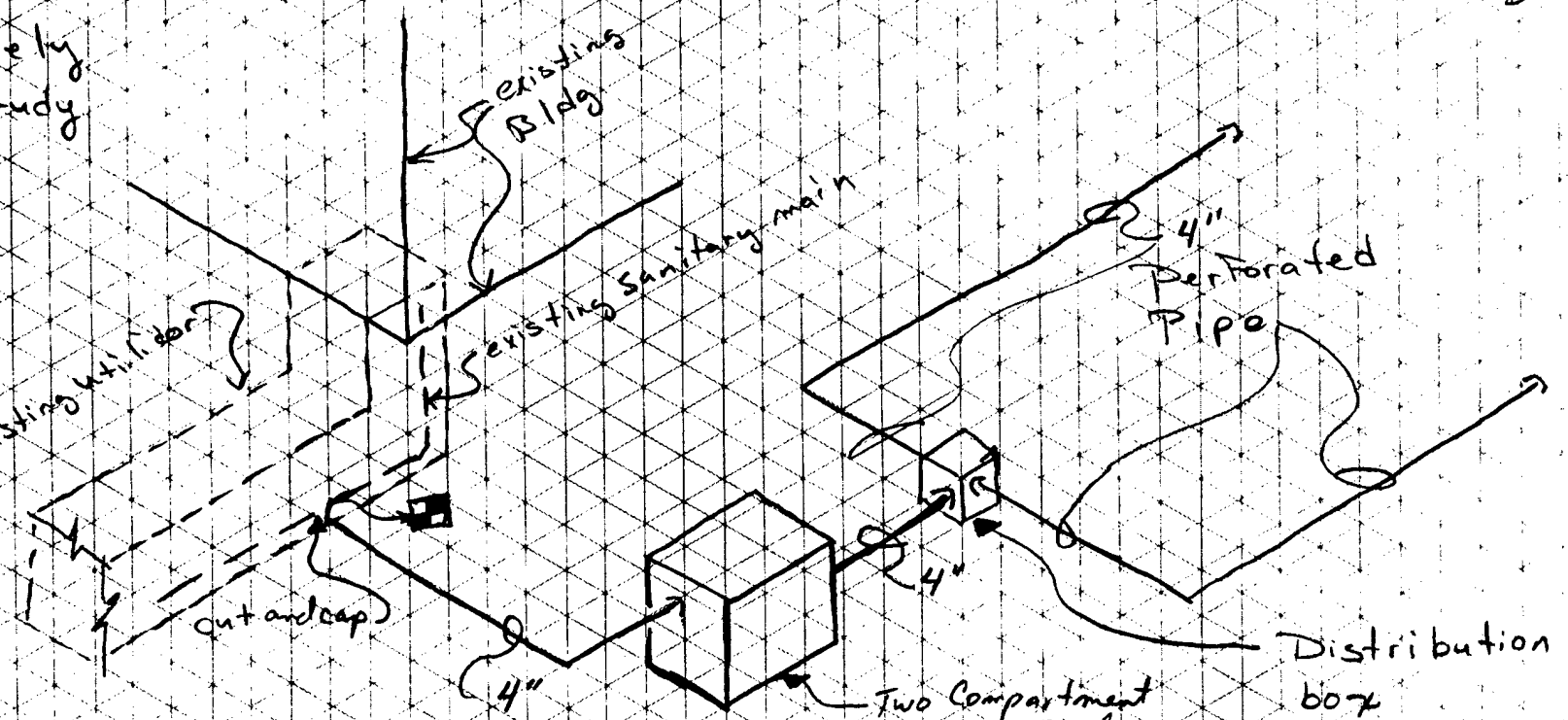
Cross sectional area of trench
= [redacted]
56 ft²

Typical Soil Absorption Trench Detail

D-28

EMC# 1406.003
Fort Greely
Utility study

12-11-95
DGM

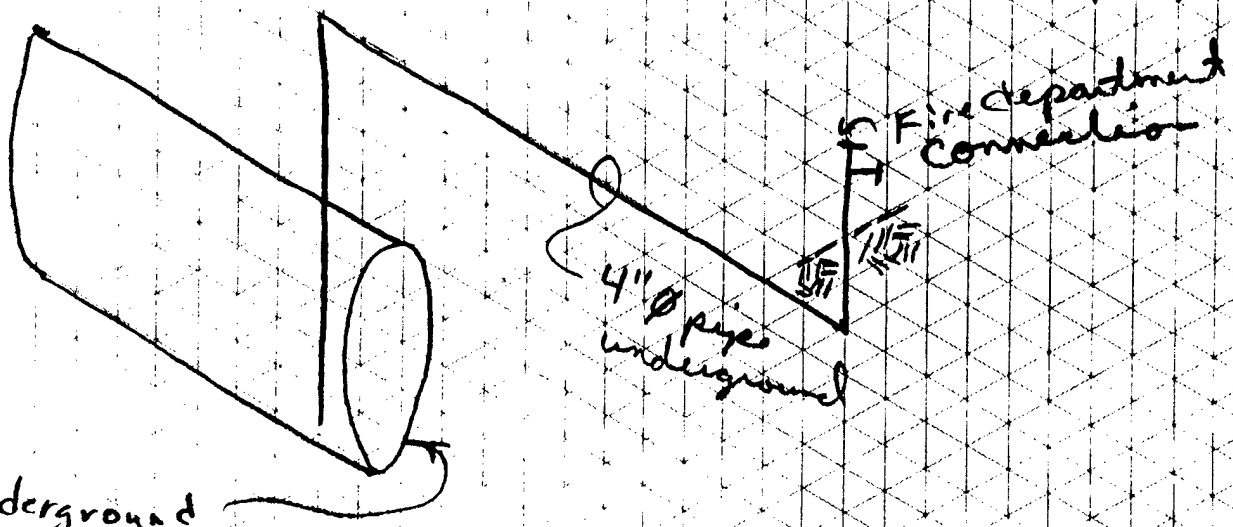


Typical Soil Absorption Field detail

(size of septic tank and lengths vary)

EMC #1406.003
Ft. Greely Utility Study

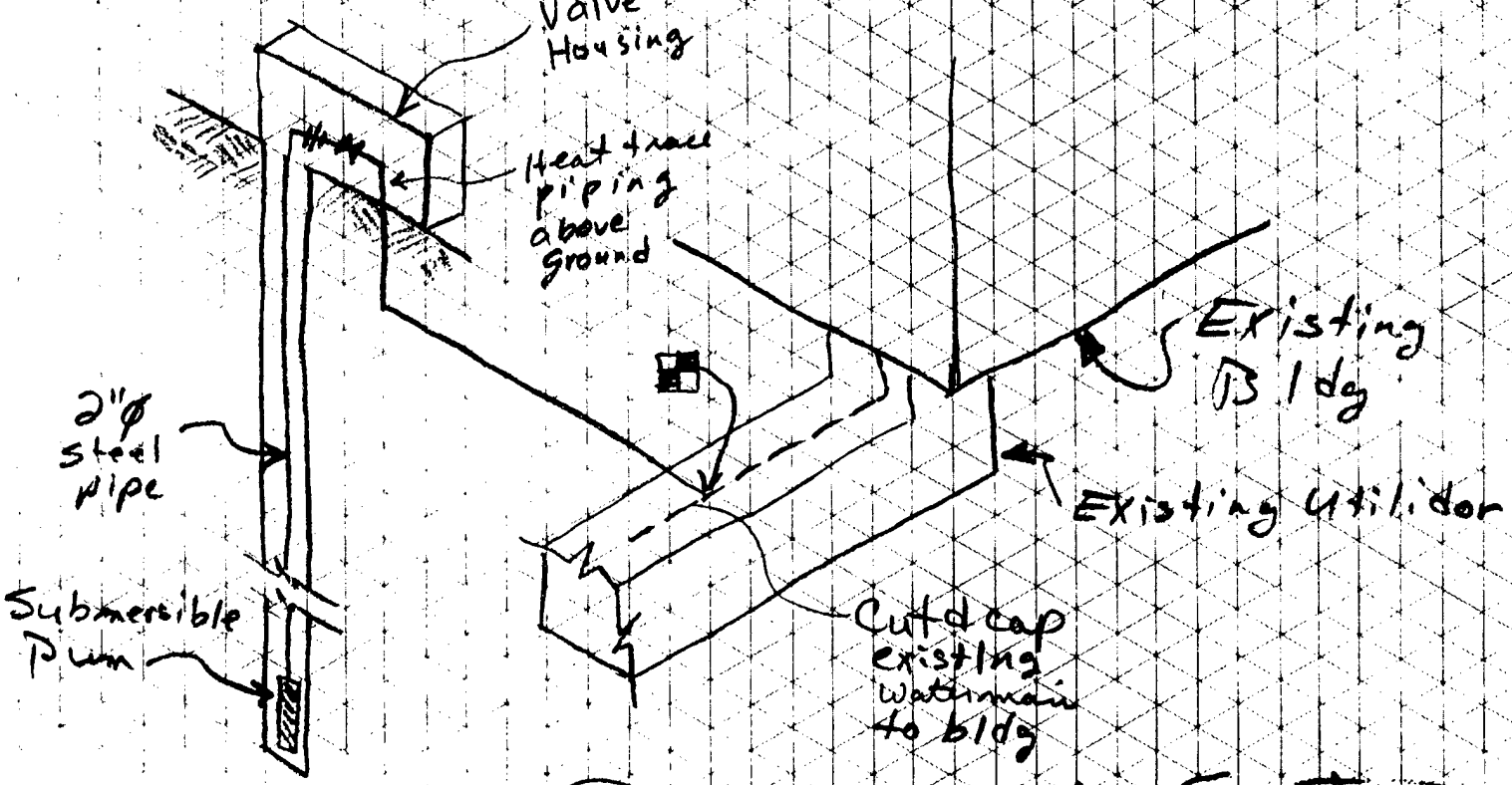
12-15-95
DGM



Fire Protection System

EMC #1406.003
Ft. Greely Utility Study

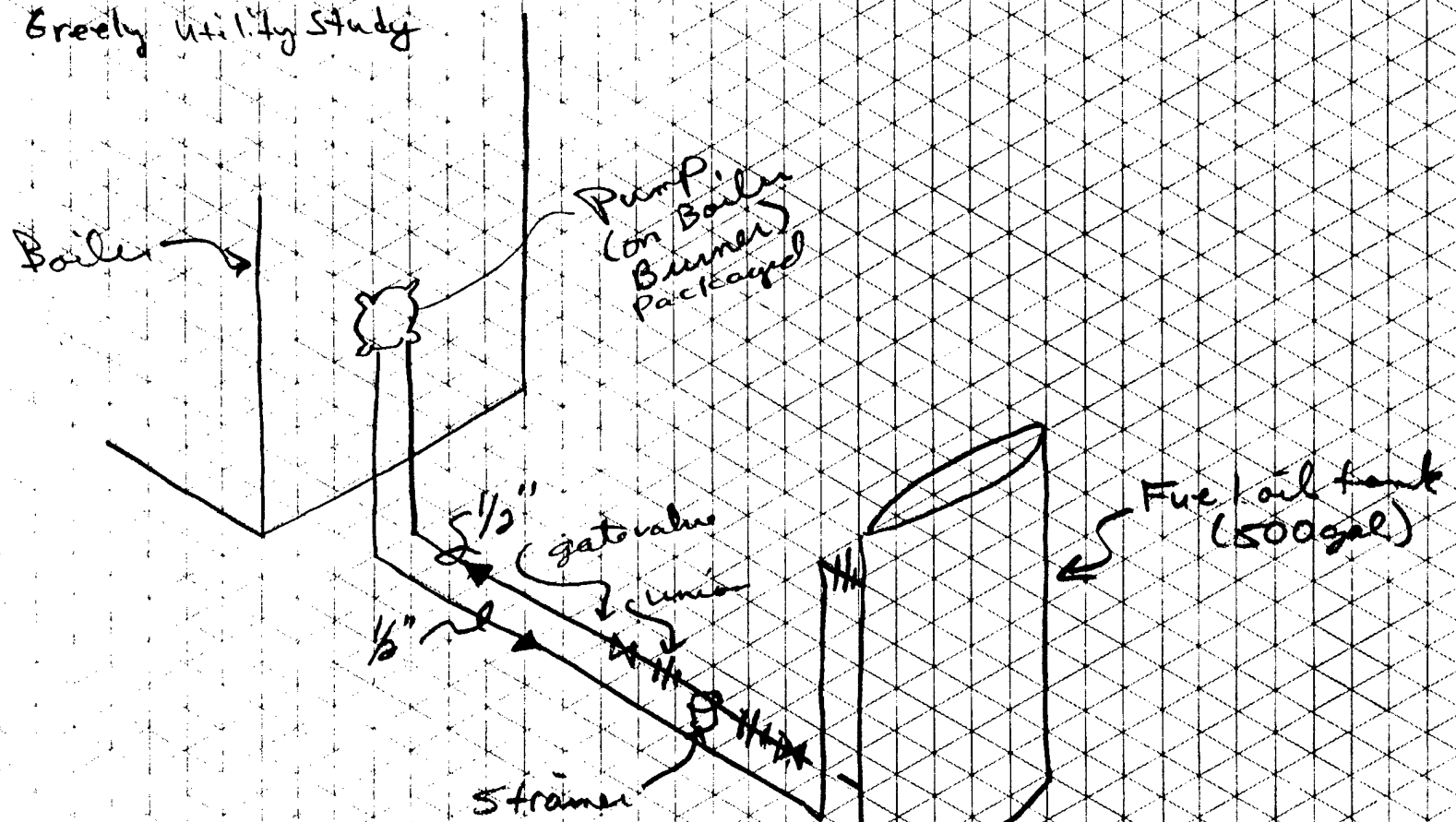
12-15-95
DGM



(1) Domestic Water System

EMC# 1406003
Ft. Greely Utility Study

12-18-95
DGM



Fuel Oil Piping

E M C ENGINEERS, INC.
2750 S. Wadsworth Blvd. Suite C-200 Denver, CO 80227 (303) 988-2951
9755 Dogwood Rd. Suite 220 Roswell, GA 30075 (404) 642-1864

JOB 1406.003
SHEET NO. ____ OF ____
CALCULATED BY DGM DATE 12-15-95
CHECKED BY ____ DATE ____
SCALE ____

Cost Estimate #'s

Septic Field

Piping to septic tank (≈ 100 ft ea bldg) (8 bldgs total)

100 ft * 56 ft² = 5600 ft³ excavation
also 5600 ft³ select backfill
100 ft of 4" Ø Cast iron pipe
MIL 15062 1003 pipe, assume 10, 1/4 & 1/8 bends MIL 15062 1229 1233

septic tank (assume 3 tank sizes for all bldgs)

(#)			
4@	1000 gal storage	– MIL 02560	6001
1@	2000 gal storage	– MIL 02560	6002
3@	5000 gal storage	– MIL 02560	6003

Distribution box (assume 5 outlet box each bldg)

7@ MIL 02560 6021

Perforated Pipe: (refer to spread sheet for lengths per bldg)
MIL 02511 2101 total overall = 13,100 ft

Excavation for leach field: (refer to spread sheet on amount per bldg)
MIL 02221 1103 total overall = 39,470 CY

Backfill for each field (refer to spread sheet on amount per bldg)

gravel backfill	Mil	02221 6002	@ 1,280 CY
Sand backfill	Mil	02221 8001	@ 1,922 CY
Select backfill	Mil	02221 5003	@ 36,270 CY
Geotextile Fabric	Mil	02512 2001	@ 18,300 L.F. 24" wide (36,600 ft²)

E M C ENGINEERS, INC.
2750 S. Wadsworth Blvd. Suite C-200 Denver, CO 80227 (303) 988-2951
9755 Dogwood Rd. Suite 220 Roswell, GA 30075 (404) 642-1864

JOB 1406.003
SHEET NO. _____ OF _____
CALCULATED BY DGM DATE 12-15-95
CHECKED BY _____ DATE _____
SCALE _____

Cost Estimate #'s

Fire Protection

Storage tanks (11 total)

50,000 gal MIL 15177 1016

Excavation

7500 ft³ /t each tank
80,880 ft³ total
MIL 02221 1103

Backfill

1500 ft³ each tank
16,500 ft³ total
MIL 02221 5003

Piping, steel
≃ 100 ft each tank
1100 ft total
MIL 15062 1003

E M C ENGINEERS, INC.
2750 S. Wadsworth Blvd. Suite C-200 Denver, CO 80227 (303) 988-2951
9755 Dogwood Rd. Suite 220 Roswell, GA 30075 (404) 642-1864

JOB 1406.003
SHEET NO. _____ OF _____
CALCULATED BY DGM DATE 12-18-95
CHECKED BY _____ DATE _____
SCALE _____

Cost Estimate #'s

Boiler Fuel oil system

500 gal steel fuel oil tank (on legs)

MIL

gate valves (2 total) MIL 15101 1103 PL

Unions (4 total) MIL 15061 1821 PL

Piping (sch 90 Black steel) ≈ 100 ft max
(1/2" ϕ) MIL 15061 1601 PL

Strainers (1 total) MIL 15083 1102 PL

check valve (1 total) MIL 15111 1104 PL

E M C ENGINEERS, INC.
2750 S. Wadsworth Blvd. Suite C-200 Denver, CO 80227 (303) 988-2951
9755 Dogwood Rd. Suite 220 Roswell, GA 30075 (404) 642-1864

JOB 14106.003
SHEET NO. ____ OF ____
CALCULATED BY DGM DATE 12-15-93
CHECKED BY ____ DATE ____
SCALE ____

Cost Estimate #'s

domestic Water Well

Drill water well including casing

@ 400 VLF MIL 02580 1001 (7 total)

submersible water pump

@ 25gpm, 527 ft head MIL 15146 3001 (7 total)

Piping

≃600 ft, 2" ø steel pipe (each Bldg.) MIL 15061 1606 (4,200 ft total)

Storage tank (see spread sheet for each bldg size) (Hydropneumatic)

(@ 2 tanks)	100 gal	$2,060
(@ 2 tanks)	200 gal	$ 2,900
(@ 1 tank)	700 gal	$ 7,750
(@ 2 tanks)	2000 gal	$15,480

MIL 15606 0000 ?

Shut off valve at pump (2") MIL 15101 1108 PL (7 total)

Isolation union (2") (7 total) MIL 15061 1806 PL

Check valve (2") MIL 15111 1109 PL (7 total)

APPENDIX E

ECO ANALYSIS

Table 2-1. Baseline O&M Cost Summary.

	Number of Maintenance Personnel Required			
	Steam System	Water System	Sewer System	Total Utilities
Foreman	0.80	0.05	0.15	1.00
Steam Fitter	1.00			1.00
Electrician	1.00			1.00
General Mechanic	0.50	0.50		1.00
Water Treatment Mechanic	-	-	1.00	1.00
Power Systems Mechanic	1.00			1.00
Boiler Operators	10.00			10.00
Subtotal	14.30	0.55	1.15	16.00
Annual Hours per Man	1,820	1,820	1,820	1,820
Burdened Cost per Hour	35	35	35	35
Annual Operating Cost	910,910	35,035	73,255	1,019,200

Table 3-2. Reduced Central Utility O&M Cost Summary.

	Number of Maintenance Personnel Required			
	Steam System	Water System	Sewer System	Total Utilities
Foreman	0.80	0.05	0.15	1.00
Steam Fitter	1.00			1.00
Electrician	1.00			1.00
General Mechanic	0.50	0.50		1.00
Water Treatment Mechanic	-	-	1.00	1.00
Power Systems Mechanic	1.00			1.00
Boiler Operators	8			8
Subtotal	12.30	0.55	1.15	14.00
Annual Hours per Man	1,820	1,820	1,820	1,820
Burdened Cost per Hour	35	35	35	35
Annual Operating Cost	783,510	35,035	73,255	891,800

Table 4-2. Distributed Utilities O&M Cost Summary.

	Number of Maintenance Personnel Required			
	Steam System	Water System	Sewer System	Total Utilities
Foreman	0.60	0.30	0.10	1.00
Steam Fitter	1.00			1.00
Electrician	-			-
General Mechanic	1.20	0.60	0.20	2.00
Water Treatment Mechanic	-	-	-	-
Power Systems Mechanic	-	-	-	-
Boiler Operators	-	-	-	-
Subtotal	2.80	0.90	0.30	4.00
Annual Hours per Man	1,820	1,820	1,820	1,820
Burdened Cost per Hour	35	35	35	35
Annual Operating Cost	178,360	57,330	19,110	254,800

	Annual Operating Costs							
	Baseline	Abandoned Buildings at 45 F No Heat	Abandoned Buildings No Heat	Abandon Selected Utilidors	Distributed Utilities	Mixed Utilities (Flow Only)	Mixed Utilities (Flow + Heat)	Mixed Utilities (Insulation)
	Baseline	at 45 F	No Heat	Utilidors	Utilities	(Flow Only)	(Flow + Heat)	(Insulation)
		Buildings	Buildings	Selected	Distributed	Utilities	Utilities	Utilities
		Abandoned	Abandoned	Abandon		Mixed	Mixed	Mixed
Steam System								
Fuel Oil Use (gal)	1,791,484	1,005,444	536,336	396,735	270,658	270,658	277,725	273,462
Electricity Use (kWh)	466,502	344,794	332,179	332,179	221,383	221,383	221,383	221,383
Electric Demand (kW)	85	39	38	38	4	4	4	4
Fuel Oil Cost ($)	1,307,783	733,974	391,525	289,617	197,580	197,580	202,739	199,627
Electricity Cost ($)	39,576	27,467	26,462	26,462	17,636	17,636	17,636	17,636
O&M Cost ($)	910,910	783,510	783,510	783,510	178,360	178,360	178,360	178,360
Total Steam Cost ($)	2,258,270	1,544,951	1,201,497	1,099,589	393,576	393,576	398,735	395,623
Water System								
Water Use (gal)	9,585,079	996,820	996,820	996,820	996,820	20,312,620	9,275,020	3,285,000
Electricity Use (kWh)	387,853	40,336	40,336	40,336	40,336	821,934	375,306	132,925
Electric Demand (kW)	-	-	-	-	-	-	-	-
Electricity Cost ($)	27,576	2,868	2,868	2,868	2,868	58,440	26,684	9,451
O&M Cost ($)	35,035	35,035	35,035	35,035	57,330	35,035	35,035	35,035
Chlorination Costs ($)	4,026	419	419	419	-	272	272	272
Total Water Cost ($)	66,637	38,322	38,322	38,322	60,198	93,747	61,991	44,758
Sewer System								
Effluent (gal)	7,197,281	816,163	816,163	816,163	816,163	21,128,782	10,091,182	4,101,163
Electricity Use (kWh)	251,919	251,919	251,919	251,919	-	-	-	-
Electric Demand (kW)	-	-	-	-	-	-	-	-
Electricity Cost ($)	19,502	19,502	19,502	19,502	-	-	-	-
O&M Cost ($)	73,255	73,255	73,255	73,255	19,110	19,110	19,110	19,110
Chlorination Costs ($)	4,020	272	272	272	-	-	-	-
Total Sewer Cost ($)	96,777	93,029	93,029	93,029	19,110	19,110	19,110	19,110
Total Utilities								
Fuel Oil Use (gal)	1,791,484	1,005,444	536,336	396,735	270,658	270,658	277,725	273,462
Electricity Use (kWh)	1,106,274	637,048	624,434	624,434	261,718	1,043,317	596,689	354,308
Electric Demand (kW)	85	39	38	38	4	4	4	4
Electricity Cost ($)	86,654	49,836	48,831	48,831	20,504	76,075	44,320	27,087
Fuel Oil Cost ($)	1,307,783	733,974	391,525	289,617	197,580	197,580	202,739	199,627
O&M Cost ($)	1,027,246	892,491	892,491	892,491	254,800	232,777	232,777	232,777
Total Utilities Cost ($)	2,421,683	1,676,301	1,332,847	1,230,939	472,884	506,432	479,836	459,491

Investment Costs								
Distributed Steam Boilers					778,779	778,779	778,779	778,779
Boiler Fuel Systems					388,761	388,761	388,761	388,761
Water Wells & Fire Cisterns					1,039,861			
Septic Systems					667,277	667,277	667,277	667,277
Water Distribution Heater						-	19,800	19,800
Water Pipe Insulation							-	143,267
Total Construction Cost ($)	-	-	-	-	2,874,678	1,834,817	1,854,617	1,997,884
SIOH (5.5%)	-	-	-	-	158,107	100,915	102,004	109,884
Design (6%)	-	-	-	-	172,481	110,089	111,277	119,873
Total Investment Cost ($)	-	-	-	-	3,205,266	2,045,821	2,067,898	2,227,641
Annual Operating Costs								
Electricity Cost ($)	86,654	49,836	48,831	48,831	20,504	76,075	44,320	27,087
Fuel Oil Cost ($)	1,307,783	733,974	391,525	289,617	197,580	197,580	202,739	199,627
O&M Cost ($)	1,027,246	892,491	892,491	892,491	254,800	232,777	232,777	232,777
Total Utilities Cost ($)	2,421,683	1,676,301	1,332,847	1,230,939	472,884	506,432	479,836	459,491
UPV Factors								
Electricity	14.47	14.47	14.47	14.47	14.47	14.47	14.47	14.47
Fuel Oil	17.01	17.01	17.01	17.01	17.01	17.01	17.01	17.01
O&M	13.47	13.47	13.47	13.47	13.47	13.47	13.47	13.47
Life Cycle Costs								
Investment	-	-	-	-	**3,205,266**	**2,045,821**	**2,067,898**	**2,227,641**
Electricity	1,253,887	721,131	706,591	706,591	296,687	1,100,809	641,310	391,944
Fuel Oil	22,245,394	12,484,896	6,659,846	4,926,383	3,360,839	3,360,839	3,448,590	3,395,660
O&M	13,837,000	12,021,849	12,021,849	12,021,849	3,432,156	3,135,506	3,135,506	3,135,506
Total Life Cycle Cost ($)	**37,336,282**	**25,227,876**	**19,388,286**	**17,654,823**	**10,294,947**	**9,642,975**	**9,293,304**	**9,150,752**

Summary Chart 1

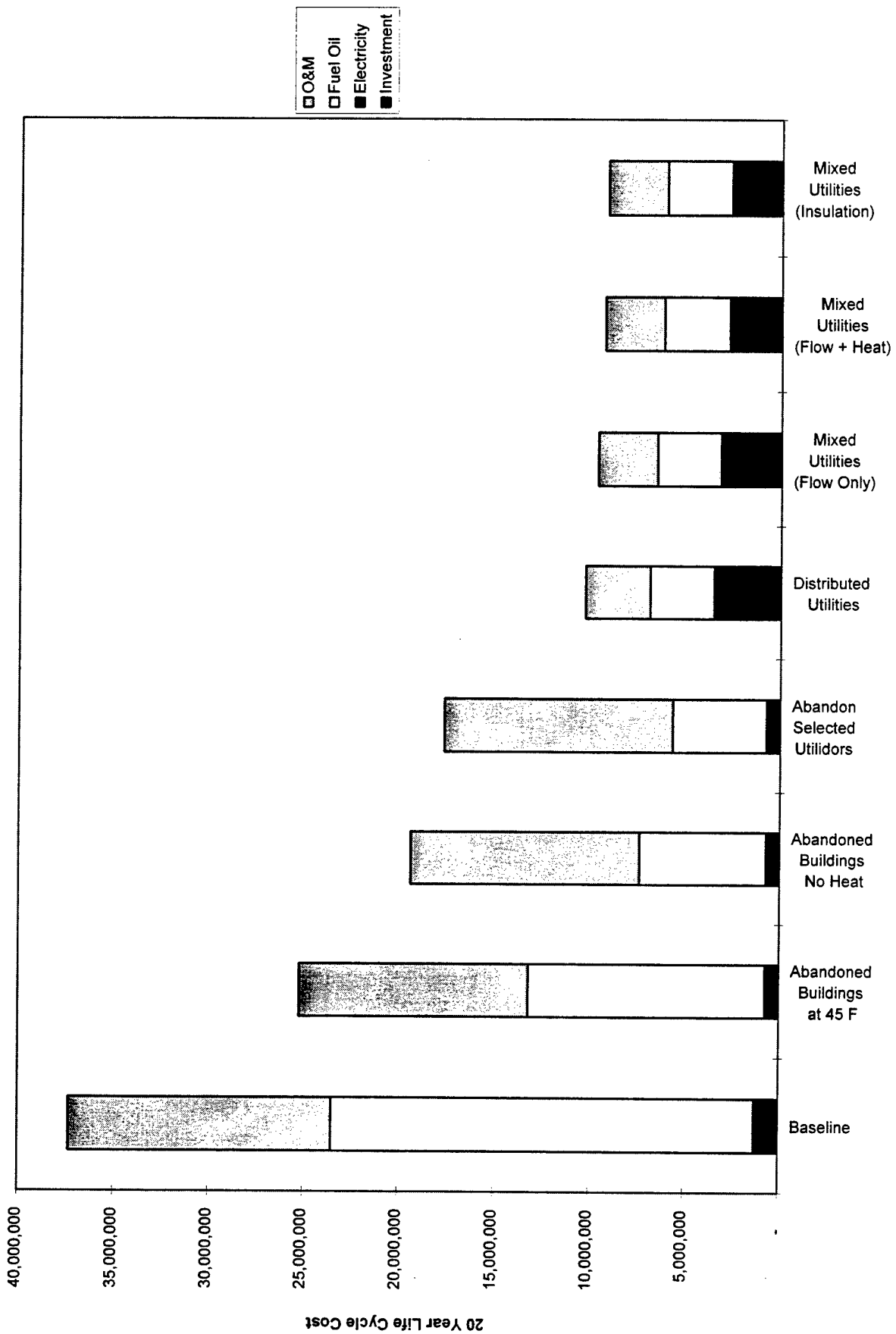


Table 4-1. Distributed Boiler Sizing and Energy Use.

Bldg #	Building Description	Required Boiler Capacity (MBH)	Annual Consumption		Annual Energy Cost	
			Fuel Oil (gal)	Electricity (kwh)	Fuel Oil ($)	Electricity ($)
501	POST HQ	754	20,080	17,870	17,590	1,271
503	GYMNASIUM	1,083	28,846	17,870	25,269	1,271
504	FIRE STATION	245	6,512	15,137	5,704	1,076
605	CONSOLIDATED PW	984	26,201	22,075	22,952	1,570
606	CENTRAL HEATING PLANT	1,238	32,950	22,075	28,864	N/A
612	TANK MAINTENANCE	738	19,645	22,075	17,209	1,570
615	MOTOR POOL	685	18,246	17,870	15,984	N/A
658	TEMP MOTOR POOL	1,004	26,737	17,870	23,422	1,271
725	SCHOOL	2,157	57,422	32,797	50,302	2,332
820	HOUSING UNIT	639	17,010	17,870	14,900	1,271
821	HOUSING UNIT	639	17,010	17,870	14,900	1,271
TOTALS		9,527	253,648	203,512	222,196	11,630

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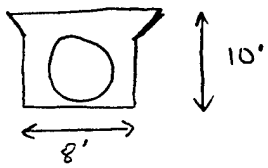
Fuel oil system for boiler at School

Cost estimate:

Components:

1) excavation For tank - 5000gal tank (dbl wall), tank size = 6'ø x 29'-6" Long
vol = 834 ft³



excavate 10'x8'x32' = 2560 ft³
add 10% for angled sides
= 2800 ft³
= 104 cy MIL 02225 1453 ?

2) Concrete anchor pad - assume 6" deep x 8' wide x 32' long
0.5*8'*32' = 128 ft³
= 4.74 cy ← Reinforced MIL 03311 1166

3) 5000gal, Dbl wall Fuel oil storage tank: MIL 15176.4002 PL

4) backfill (select) 2800 ft³ - 834 ft³ - 128 ft³ = 1838 ft³ = 68 cy
MIL

5) Containment basin / tank sump (42"ø) #4110

6) FOS Pump (15gpm) $725

7) 100 ft, 3/4" FOS pipe MIL 15061 1602 PL

8) 50 gal day tank $1,100

9) 5-90° elbows
2 gate valves
4 unions
MIL 15061 1638 PL
MIL 15101 1104 PL
MIL 15061 1822 PL

10) Leak Detector System MIL 15176 6011 PL

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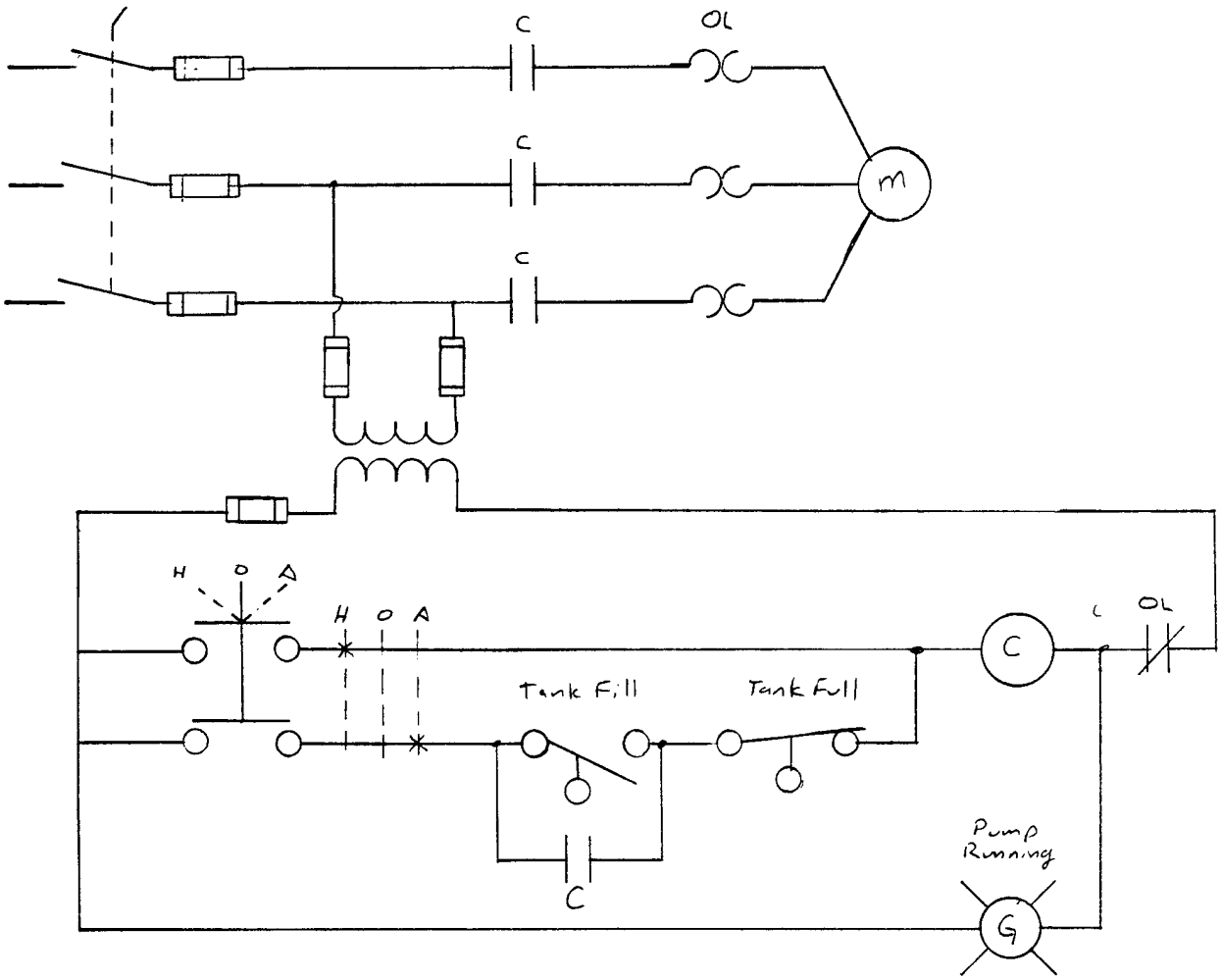
JOB Ft. Greely

SHEET NO. 1 OF 1

CALCULATED BY D. Morris DATE 1/9/96

CHECKED BY _____ DATE _____

SCALE None



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JOB 1406-003 Ft. Greely
SHEET NO. _____ OF _____
CALCULATED BY DEJ DATE 1-9-96
CHECKED BY _____ DATE _____
SCALE _____

Fuel Oil System for Bldgs 503, 605, 615, 820, & 821

Cost Estimate

1.) Excavation for fuel tank - 2000 gal → 270 ft³
6' Dia × 10' Long

Excavate 10' × 8' × 12' = 960 ft³
+10% 96
1056 ft³ = 39 cy

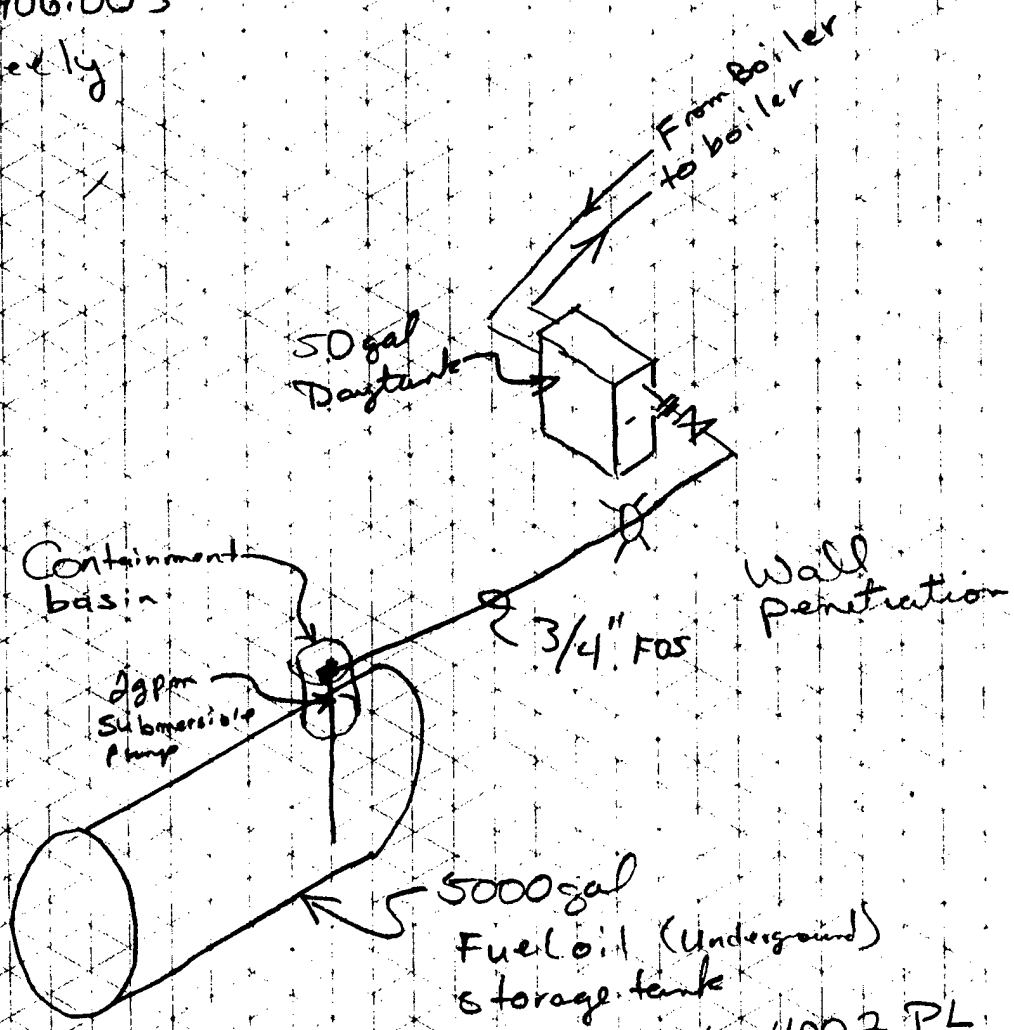
2.) Conc. anchor pad 6" × 8' × 12' = 1.8 cy

3.) 2000 gal, Fuel Tank

4.) Backfill 1056 − 270 − 48 = 738 ft³ = 27 cy

EMC #1406.003
Ft Greely

1-8-96
DGM



FOS System For School
NTS

APPENDIX E

ECO SIMULATIONS AND ANALYSIS

Table 2-1. Baseline O&M Cost Summary.

	Number of Maintenance Personnel Required			
	Steam System	Water System	Sewer System	Total Utilities
Foreman	0.80	0.05	0.15	1.00
Steam Fitter	1.00			1.00
Electrician	1.00			1.00
General Mechanic	0.50	0.50		1.00
Water Treatment Mechanic	-	-	1.00	1.00
Power Systems Mechanic	1.00			1.00
Boiler Operators	10.00			10.00
Subtotal	14.30	0.55	1.15	16.00
Annual Hours per Man	1,820	1,820	1,820	1,820
Burdened Cost per Hour	40.00	40.00	40.00	40.00
Annual Operating Cost	1,041,040	40,040	83,720	1,164,800

Table 3-2. Reduced Central Utility O&M Cost Summary.

	Number of Maintenance Personnel Required			
	Steam System	Water System	Sewer System	Total Utilities
Foreman	0.80	0.05	0.15	1.00
Steam Fitter	1.00			1.00
Electrician	1.00			1.00
General Mechanic	0.50	0.50		1.00
Water Treatment Mechanic	-	-	1.00	1.00
Power Systems Mechanic	1.00			1.00
Boiler Operators	8			8
Subtotal	12.30	0.55	1.15	14.00
Annual Hours per Man	1,820	1,820	1,820	1,820
Burdened Cost per Hour	40	40	40	40
Annual Operating Cost	895,440	40,040	83,720	1,019,200

Table 4-2. Distributed Utilities O&M Cost Summary.

	Number of Maintenance Personnel Required			
	Steam System	Water System	Sewer System	Total Utilities
Foreman	0.60	0.20	0.20	1.00
Steam Fitter	-			-
Electrician	-			-
General Mechanic	0.80	0.20		1.00
Water Treatment Mechanic	-	-	-	-
Power Systems Mechanic	-	-	-	-
Boiler Operators	-	-	-	-
Subtotal	1.40	0.40	0.20	2.00
Annual Hours per Man	1,820	1,820	1,820	1,820
Burdened Cost per Hour	40	40	40	40
Annual Operating Cost	101,920	29,120	14,560	145,600

	Annual Operating Costs							
	Baseline	Abandoned Buildings at 45 F	Abandoned Buildings No Heat	Abandon Selected Utilidors	Distributed Utilities	Mixed Utilities (Flow Only)	Mixed Utilities (Flow + Heat)	Mixed Utilities (Insulation)
Steam System								
Fuel Oil Use (gal)	1,791,484	1,022,993	485,708	346,107	190,112	197,179	197,179	192,916
Electricity Use (kWh)	529,044	344,794	332,179	332,179	159,362	159,362	159,362	159,362
Electric Demand (kW)	85	39	38	38	18	18	18	18
Fuel Oil Cost ($)	1,307,783	746,785	354,567	252,658	138,782	143,941	143,941	140,829
Electricity Cost ($)	44,023	27,467	26,462	26,462	12,695	12,695	12,695	12,695
O&M Cost ($)	1,041,040	895,440	895,440	895,440	101,920	101,920	101,920	101,920
Total Steam Cost ($)	2,392,846	1,669,691	1,276,469	1,174,560	253,397	258,556	258,556	255,444
Water System								
Water Use (gal)	9,571,746	646,622	646,622	646,622	646,622	3,285,000	8,924,822	3,285,000
Electricity Use (kWh)	387,313	26,165	26,165	26,165	26,165	132,925	361,136	132,925
Electric Demand (kW)	-	-	-	-	-	-	-	-
Electricity Cost ($)	27,538	1,860	1,860	1,860	1,860	9,451	25,677	9,451
O&M Cost ($)	40,040	40,040	40,040	40,040	29,120	40,040	40,040	40,040
Chlorination Costs ($)	4,020	272	272	272	-	272	272	272
Total Water Cost ($)	71,598	42,172	42,172	42,172	30,980	49,763	65,989	49,763
Sewer System								
Effluent (gal)	7,187,405	478,979	478,979	478,979	478,979	478,979	478,979	478,979
Electricity Use (kWh)	251,919	251,919	251,919	251,919	-	-	-	-
Electric Demand (kW)	-	-	-	-	-	-	-	-
Electricity Cost ($)	19,502	19,502	19,502	19,502	-	-	-	-
O&M Cost ($)	83,720	83,720	83,720	83,720	14,560	14,560	14,560	14,560
Chlorination Costs ($)	4,020	272	272	272	-	-	-	-
Total Sewer Cost ($)	107,242	103,494	103,494	103,494	14,560	14,560	14,560	14,560
Total Utilities								
Fuel Oil Use (gal)	1,791,484	1,022,993	485,708	346,107	190,112	197,179	197,179	192,916
Electricity Use (kWh)	1,168,277	622,878	610,264	610,264	185,527	292,287	520,498	292,287
Electric Demand (kW)	85	39	38	38	18	18	18	18
Electricity Cost ($)	91,063	48,829	47,824	47,824	14,555	22,146	38,372	22,146
Fuel Oil Cost ($)	1,307,783	746,785	354,567	252,658	138,782	143,941	143,941	140,829
O&M Cost ($)	1,172,840	1,019,744	1,019,744	1,019,744	145,600	156,792	156,792	156,792
Total Utilities Cost ($)	2,571,686	1,815,357	1,422,134	1,320,226	298,937	322,879	339,104	319,767

Investment Costs								
Distributed Steam Boilers					376,039	376,039	376,039	376,039
Boiler Fuel Systems					142,477	142,477	142,477	142,477
Water Wells & Fire Cisterns					1,049,944			
Septic Systems					526,136	526,136	526,136	526,136
Water Distribution Heater							19,800	19,800
Water Pipe Insulation								76,549
Total Construction Cost ($)	-	-	-	-	2,094,596	1,044,652	1,064,452	1,141,001
SIOH (5.5%)	-	-	-	-	115,203	57,456	58,545	62,755
Design (6%)	-	-	-	-	125,676	62,679	63,867	68,460
Total Investment Cost ($)	-	-	-	-	2,335,475	1,164,787	1,186,864	1,272,216
Annual Operating Costs								
Electricity Cost ($)	91,063	48,829	47,824	47,824	14,555	22,146	38,372	22,146
Fuel Oil Cost ($)	1,307,783	746,785	354,567	252,658	138,782	143,941	143,941	140,829
O&M Cost ($)	1,172,840	1,019,744	1,019,744	1,019,744	145,600	156,792	156,792	156,792
Total Utilities Cost ($)	2,571,686	1,815,357	1,422,134	1,320,226	298,937	322,879	339,104	319,767
UPV Factors								
Electricity	14.47	14.47	14.47	14.47	14.47	14.47	14.47	14.47
Fuel Oil	17.01	17.01	17.01	17.01	17.01	17.01	17.01	17.01
O&M	13.47	13.47	13.47	13.47	13.47	13.47	13.47	13.47
Life Cycle Costs								
Investment	-	-	-	-	**2,335,475**	**1,164,787**	**1,186,864**	**1,272,216**
Electricity	1,317,677	706,552	692,012	692,012	210,616	320,453	555,240	320,453
Fuel Oil	22,245,394	12,702,807	6,031,178	4,297,715	2,360,678	2,448,429	2,448,429	2,395,500
O&M	15,798,157	13,735,946	13,735,946	13,735,946	1,961,232	2,111,988	2,111,988	2,111,988
Total Life Cycle Cost ($)	**39,361,227**	**27,145,305**	**20,459,135**	**18,725,672**	**6,868,001**	**6,045,657**	**6,302,521**	**6,100,157**

Summary Chart 1

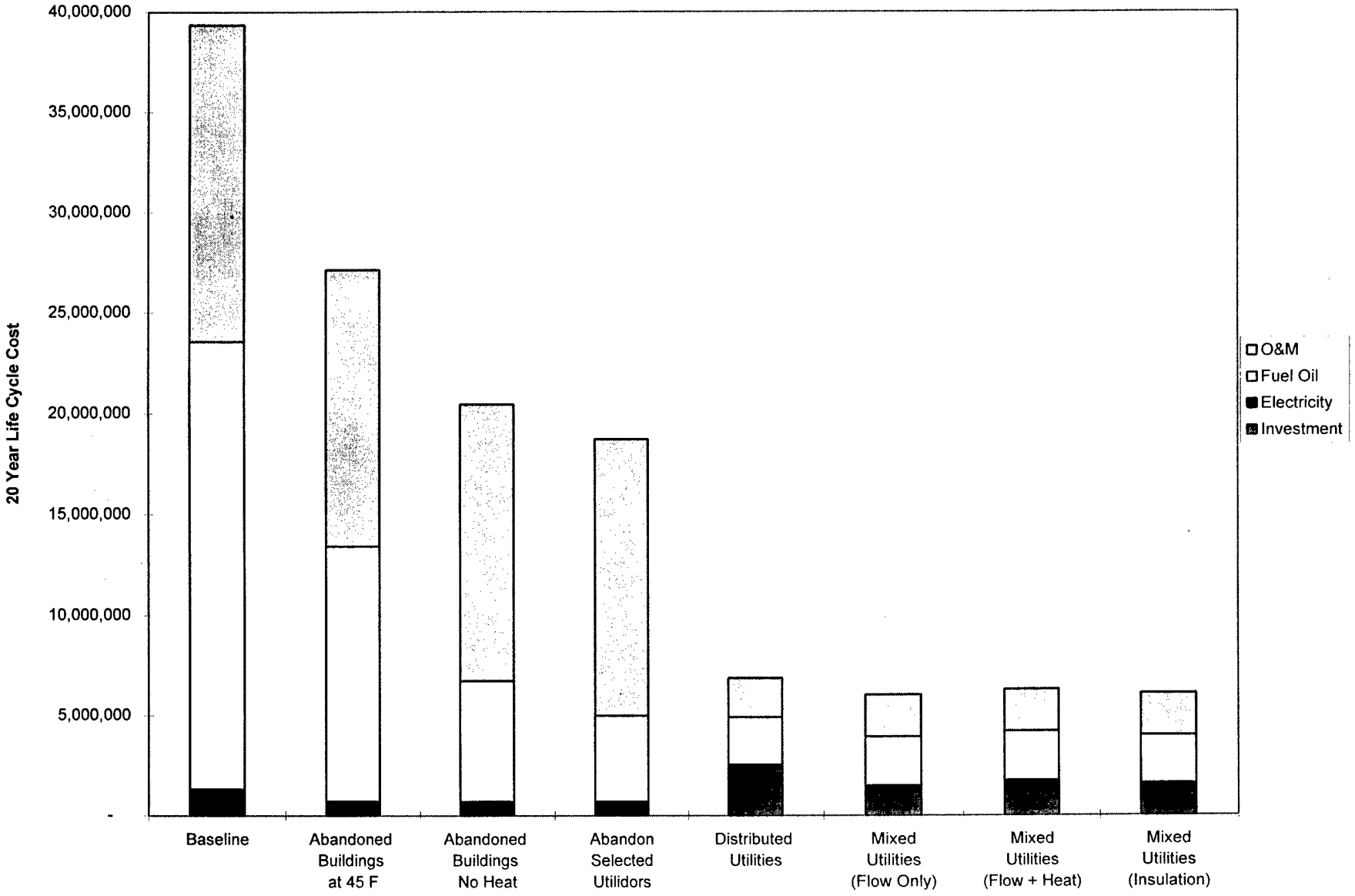


Table 4-1. Distributed Boiler Sizing.

Bldg #	Building Description	Required Boiler Capacity (MBH)	Annual Consumption		Annual Energy Cost		Fuel Tank (gal)	Days between Fills (days)	Fuel System Cost ($)
			Fuel Oil (gal)	Electricity (kwh)	Fuel Oil ($)	Electricity ($)			
501	Post HQ	791	21,037	17,870	15,357	1,271	N/A	N/A	N/A
503	Gymnasium	929	24,711	17,870	18,039	1,271	2,000	30	21,766
504	Fire Station	256	6,822	15,137	4,980	1,076	650	35	3,592
605	Public Works	1,032	27,449	22,075	20,038	1,570	2,000	27	21,766
606	Steam Plant	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
615	Motor Pool	718	19,116	17,870	13,955	1,271	2,000	38	21,766
633	Sewage Trmt	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
725	School	2,080	55,337	32,797	40,396	2,332	5,000	33	30,055
820	Housing	670	17,820	17,870	13,009	1,271	2,000	41	21,766
821	Housing	670	17,820	17,870	13,009	1,271	2,000	41	21,766
TOTALS		7,145	190,112	159,362	138,782	11,331			142,477

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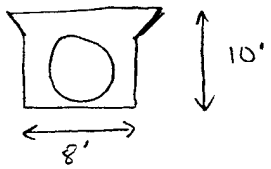
Fuel oil system for boiler at School

Cost estimate:

Components:

1) excavation For tank - 5000gal tank (dbl wall), tank size = 6'ø x 29'-6" Long
vol = 834 ft³



excavate 10'x8'x32' = 2560 ft³
add 10% for angled sides
= 2800 ft³
= 104 cy MIL 02225 1453 ?

2) Concrete anchor pad - assume 6" deep x 8' wide x 32' long
0.5'*8'*32' = 128 ft³
= 4.74 cy ← Reinforced MIL 03311 1166

3) 5000gal, Dbl wall Fuel oil storage tank: MIL 15176.4002 PL

4) backfill (select) 2800 ft³ - 834 ft³ - 128 ft³ = 1838 ft³ = 68 cy
MIL

5) Containment basin / tank sump (42"ø) #4110

6) FOS Pump (15gpm) #725

7) 100 ft, 3/4" FOS pipe MIL 15061 1602 PL

8) 50 gal day tank #1,100

9) 5-90° elbows
2 gate valves MIL 15061 1632 PL
4 unions MIL 15101 1104 PL
MIL 15061 1822 PL

10) Leak Detector System MIL 15176 6011 PL

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Roswell, GA 30075
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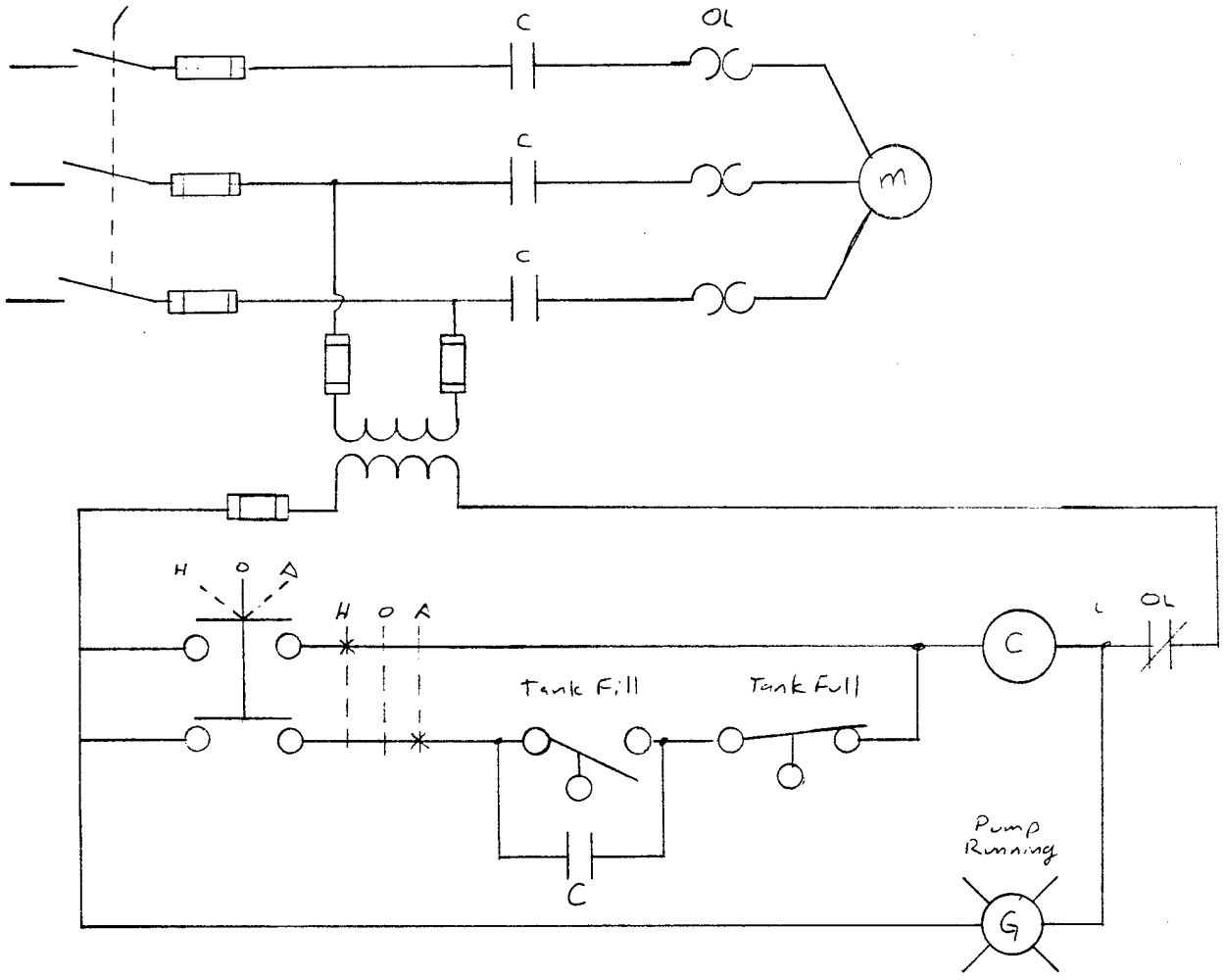
JOB Ft. Greely

SHEET NO. 1 OF 1

CALCULATED BY D. Morris DATE 1/9/96

CHECKED BY _____ DATE _____

SCALE None



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JOB 1406-003 Ft. Greely
SHEET NO. _____ OF _____
CALCULATED BY DEJ DATE 1-9-96
CHECKED BY _____ DATE _____
SCALE _____

Fuel Oil System for Bldgs 503, 605, 615, 820, & 821

Cost Estimate

1.) Excavation for fuel tank - 2000 gal → 270 ft³
6' Dia x 10' Long

Excavate 10' x 8' x 12' = 960 ft³
+10% 96
1056 ft³ = 39 cy

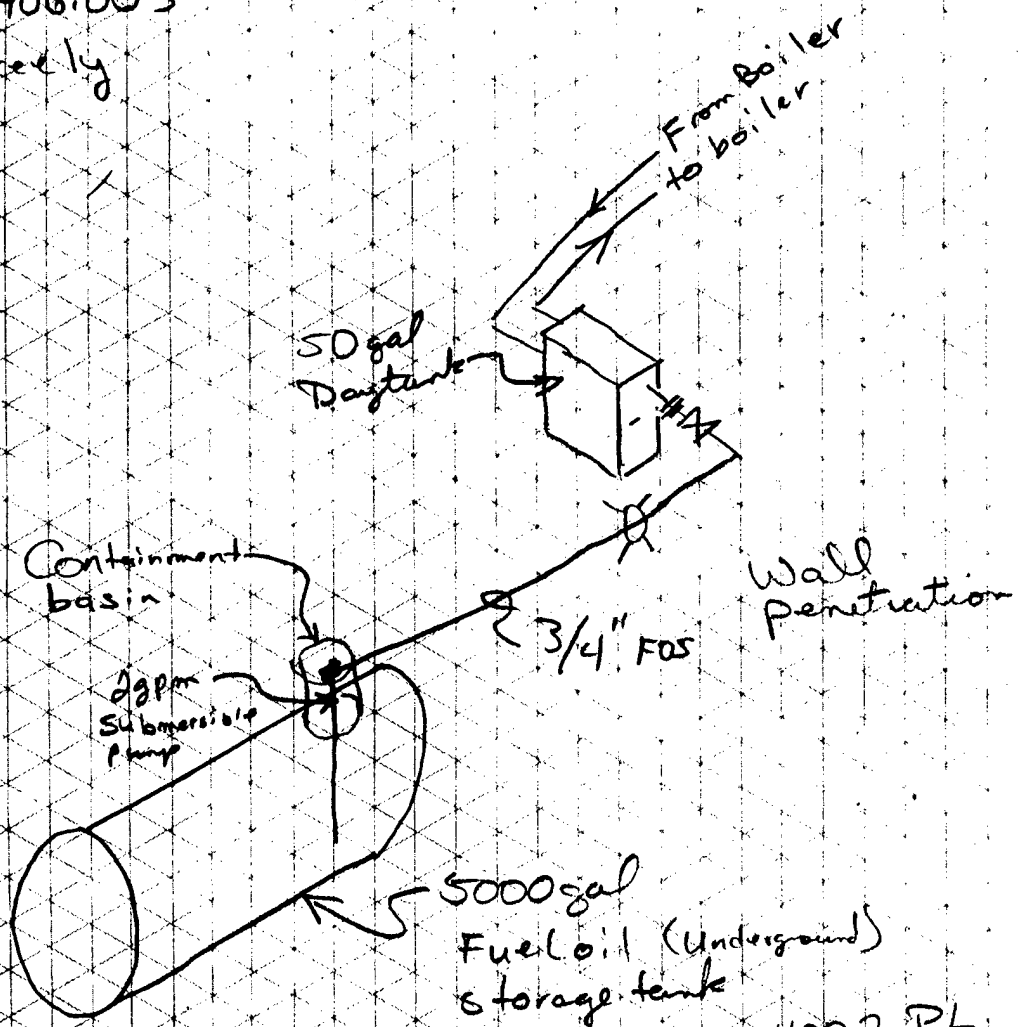
2.) Conc. anchor pad 6" x 8' x 12' = 1.8 cy

3.) 2000 gal, Fuel Tank

4.) Backfill 1056 - 270 - 48 = 738 ft³ = 27 cy

EMC # 1406.003
Mt Greely

1-8-96
DGM



FOS System For School
NTS

APPENDIX F

LCCA AND ECONOMIC ANALYSIS

F1 Distributed Steam Boilers

F2 Fuel Oil Tank - 5000 Gallons

F3 Fuel Oil Tank - 2000 Gallons

F4 Fuel Oil Tank - 1000 Gallons

F5 Water Wells to Cisterns

F6 Septic Field

F7 Water Pipe Insulation

F8 Potable Water Heater

Distributed Steam Boilers

Distributed Boilers
Fort Greely Utility Study
Install Distributed Boilers in
Unheated Abandoned Buildings

Designed By: JVS
Estimated By:

Prepared By: TCP

Preparation Date: 03/18/96
Effective Date of Pricing: 03/18/06

Sales Tax: 0.00%

F1-1

SUMMARY REPORTS SUMMARY PAGE

DETAILED ESTIMATE DETAIL PAGE

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

		QUANTITY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST	UNIT COST
1	Bldg. 503 - Gymnasium	1.00	EA	36,892	357	14,737	866	52,495	52495.39
2	Bldg. 504 - Fire Station	1.00	EA	20,396	179	7,392	88	27,876	27875.68
3	Bldg. 605 - Cons. Public Works	1.00	EA	35,134	322	13,294	758	49,185	49185.30
4	Bldg. 615 - Motor Pool	1.00	EA	26,751	265	10,948	581	38,280	38280.26
5	Bldg. 725 - School	1.00	EA	73,898	410	16,893	1,009	91,799	91799.45
6	Bldg. 820 - Housing	1.00	EA	26,557	263	10,874	580	38,011	38011.27
7	Bldg. 821 - Housing	1.00	EA	26,557	263	10,874	580	38,011	38011.27
8	Bldg. 606 - Central Heating Plt	1.00	EA	36,892	357	14,737	866	52,495	52495.39
9	Bldg. 612 - Tank Maintenance	1.00	EA	26,751	265	10,948	581	38,280	38280.26
10	Bldg. 658 - Temporary Motor Pool	1.00	EA	36,892	357	14,737	866	52,495	52495.39
TOTAL	Distributed Boilers	1.00	EA	346,721	3,039	125,433	6,775	478,930	478929.65
	Contractor's Overhead							71,839	
	SUBTOTAL							550,769	
	Contractor's Profit							55,077	
	SUBTOTAL							605,846	
	Contractor's Bond							18,175	
	TOTAL INCL INDIRECTS							624,021	
	Escalation							24,961	
	SUBTOTAL							648,982	
	Contingency							129,796	
	TOTAL INCL OWNER COSTS							778,779	

1.09. HVAC	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
1. Bldg. 503 - Gymnasium							
1.09. HVAC This system includes all equipment, distrbution systems, controls, and energy supply systems required by the heating, ventilating, and air conditioning system.							
1.09.02. Heating Generating Systems This subsystem includes steam, hot water, furnace, and heater systems. Fuel include coal, oil, gas and electric unless otherwise noted.							
1.09.02.01. Steam Boilers Assemblies include boilers, expansion tanks, chemical feeders, air separators, pumps, heat exchangers, boiler feed units, etc. This assembly would also include fittings and specialties and the flue stack. The unit of measure at the assembly level is each.							
M MIL AA <15624 1012 > 1764 MBH Oil Fired H2O Tube Blr Stl Shell w/Insul Jacket & Ctrls	2.00	EA	32,031	265	10,825	815	43,671
TOTAL Steam Boilers			32,031	265	10,825	815	43,671
TOTAL Heating Generating Systems			32,031	265	10,825	815	43,671
1.09.04. Distribution Systems This includes systems that distribute heated and cooled air, ventilating and exhaust air, hot and chilled water, steam, and glycol heating.							
1.09.04.02. Steam Distribution Systems Assemblies include pipe and fitting, including supports, wall and floor sleeves, and pipe insulation. The unit of measure at the assembly level is MBH.							
M MIL AA <15061 1608 > 3"(80mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	20.00	LF	77	3	139	1	217
M MIL AA <15185 1008 > 3"D Pipe,1" Thk Fbgs Pipe Cover w/Fire Retardant Jackets	20.00	LF	31	2	60	1	92
M MIL AA <15101 1304 > 3" Iron Body Gate Valve, Thrd 125# Bronze Mtd w/Threaded Valve	3.00	EA	476	5	206	2	684
M MIL AA <15061 1638 > 3" 90 Degree Ell,150# MI Black	6.00	EA	46	6	263	2	311
M MIL AA <15061 1698 > 3" Tee, Red Out 150# MI Black	1.00	EA	12	1	52	0	64
M MIL AA <15061 1612 > 6"(15cm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	6.00	LF	57	2	73	1	131
M MIL AA <15185 1011 > 6"D Pipe,1-1/2"Thk Fbgs Pipe Cvr w/Fire Retardant Jackets	6.00	LF	12	1	25	0	37
B MIL AA <15061 2388 > 6" Thread-O-Let, 300# Forge Stl 20% added for 6" fitting	3.00	EA	140	9	375	13	529
M MIL AA <15083 1103 > 3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends	1.00	EA	44	0	19	0	64
M MIL AA <15125 2001 > 3/4"Float&Tstat Steam Trap,15PSI	1.00	EA	64	1	28	0	92
M MIL AA <15061 1822 > 3/4" Union, 150# MI Black	4.00	EA	5	2	64	1	70
M MIL AA <15061 1602 > 3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	10.00	LF	6	1	27	0	33

1.09. HVAC			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15185 1002 >	3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets		10.00	LF	9	1	25	0	35
M MIL AA <15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered		2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 >	3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst		2.00	EA	33	1	39	0	73
M MIL AA <15855 1145 >	12"x 3' Round Flue/Vent Pipe Galv Dbl Wall Breech/Smoke Pipe		10.00	EA	469	8	328	3	800
M MIL AA <15855 1186 >	12" Round Flue/Vent Pipe Tees Galv Dbl Wall Breech/Smoke Pipe		2.00	EA	137	4	166	2	305
M MIL AA <15855 1216 >	12"Rnd Flue/Vent Adj Roof Flash Galv Dbl Wall Breech/Smoke Pipe		2.00	EA	35	1	55	1	91
M MIL AA <15855 1196 >	12" Round Flue/Vent Top Caps Galv Dbl Wall Breech/Smoke Pipe		2.00	EA	109	1	55	1	165
M MIL AA <15063 1004 >	1"(25mm) Cu Pipe/Tubing Type L Flue Drain		20.00	LF	26	1	57	1	83
M MIL AA <15104 1103 >	1" Threaded Ball Valve, CS Trim Regular Port, Flue Drain		2.00	EA	37	1	47	0	84
M MIL AA <15063 1044 >	1" 90 Degree Elbow, Copper Flue Drain		5.00	EA	4	1	60	1	65
M MIL AA <15063 1006 >	1-1/2"(40mm) Cu Pipe/Tubing Tp L		30.00	LF	67	3	115	1	183
M MIL AA <15185 1005 >	1-1/2"D Pipe,1"Thk Fib Pipe Cvr w/Fire Retardant Jackets		30.00	LF	34	2	83	1	118
M MIL AA <15122 1105 >	1-1/2" x 1-1/2" Brz PRV, Thrd Boiler Relief Valves		2.00	EA	260	2	71	1	332
M MIL AA <15061 1635 >	1-1/2" 90 Deg Ell, 150# MI Black Boiler Relief Valve		2.00	EA	3	1	35	0	38
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot		2.00	EA	49	2	79	3	131
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Drain		15.00	LF	14	1	36	0	50
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Drain		4.00	EA	1	1	38	0	40
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Fill		30.00	LF	28	2	72	1	100
M MIL AA <15121 1202 >	3/4"Thrd St Press Regul & Red,IB Sgl Seat,Sprg Load Dir Act Diap Boiler Fill		1.00	EA	102	1	43	0	145
M MIL AA <15104 1102 >	3/4" Thrd Ball Valve, CS Trim Regular Port, Boiler Fill		3.00	EA	42	2	67	1	109
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends, Boiler Fill		1.00	EA	44	0	19	0	64
M MIL AA <15080 3201 >	3.5"Diameter Dial Pressure Gauge Aluminum Case 0-300PSI Boiler Fill		1.00	EA	57	1	28	0	85
M MIL AA <15122 1102 >	3/4"x3/4"Brz Press Rlf Vlv, Thrd Boiler Fill		1.00	EA	14	1	22	0	36
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Fill		5.00	EA	2	1	48	0	50
M MIL AA <15063 1023 >	3/4" Copper Tee - Straight Sweat Boiler Fill		2.00	EA	1	1	29	0	30

1.09. HVAC

		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15720 2002 >	Duplex Pump & Motor, 1 HP, 25GPM Cnds Pump w/CI Receiver,Float Sw, Condensate Return Pumps	1.00	EA	2,150	13	554	6	2,710
M MIL AA <15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings Condensate Return Pumps	40.00	LF	25	3	107	1	134
M MIL AA <15185 1002 >	3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets	40.00	LF	36	3	102	1	139
M MIL AA <15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered Condensate Return Pumps	2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 >	3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst, Condensate Return Pumps	1.00	EA	17	0	19	0	36
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot	1.00	EA	25	1	40	1	66
M CIV AA <02113 6011 >	Rem 1/2" to 4" D Asb Pipe Insul Air-Cell Glove, Semi-Isolated	5.00	LF	20	1	22	2	44
CIV AA <02111 9202 >	Demo Metal Pipe to 4"(10cm)D Cut piping for connection to existing system (8).	5.00	LF	0	0	19	0	19
M MIL AA <15061 1636 >	2" 90 Degree ELL,150# MI Black For connection to existing system	1.00	EA	2	1	22	0	25
TOTAL	Steam Distribution Systems			4,861	93	3,912	51	8,824
TOTAL	Distribution Systems			4,861	93	3,912	51	8,824
TOTAL	HVAC			36,892	357	14,737	866	52,495
TOTAL	Bldg. 503 - Gymnasium			36,892	357	14,737	866	52,495

2.09. HVAC	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
2. Bldg. 504 - Fire Station							
2.09. HVAC This system includes all equipment, distrbution systems, controls, and energy supply systems required by the heating, ventilating, and air conditioning system.							
2.09.02. Heating Generating Systems This subsystem includes steam, hot water, furnace, and heater systems. Fuel include coal, oil, gas and electric unless otherwise noted.							
2.09.02.01. Steam Boilers Assemblies include boilers, expansion tanks, chemical feeders, air separators, pumps, heat exchangers, boiler feed units, etc. This assembly would also include fittings and specialties and the flue stack. The unit of measure at the assembly level is each.							
M MIL AA <15624 1004 > 490 MBH Oil Fired H2O Tube Blr Stl Shell w/Insul Jacket & Ctrls	2.00	EA	16,076	93	3,761	41	19,878
TOTAL Steam Boilers			16,076	93	3,761	41	19,878
TOTAL Heating Generating Systems			16,076	93	3,761	41	19,878
2.09.04. Distribution Systems This includes systems that distribute heated and cooled air, ventilating and exhaust air, hot and chilled water, steam, and glycol heating.							
2.09.04.02. Steam Distribution Systems Assemblies include pipe and fitting, including supports, wall and floor sleeves, and pipe insulation. The unit of measure at the assembly level is MBH.							
M MIL AA <15061 1608 > 3"(80mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	20.00	LF	77	3	139	1	217
M MIL AA <15185 1008 > 3"D Pipe,1" Thk Fbgs Pipe Cover w/Fire Retardant Jackets	20.00	LF	31	2	60	1	92
M MIL AA <15101 1304 > 3" Iron Body Gate Valve, Thrd 125# Bronze Mtd w/Threaded Valve	3.00	EA	476	5	206	2	684
M MIL AA <15061 1638 > 3" 90 Degree Ell,150# MI Black	6.00	EA	46	6	263	2	311
M MIL AA <15061 1698 > 3" Tee, Red Out 150# MI Black	1.00	EA	12	1	52	0	64
M MIL AA <15061 1602 > 3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	10.00	LF	6	1	27	0	33
M MIL AA <15185 1002 > 3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets	10.00	LF	9	1	25	0	35
M MIL AA <15101 1104 > 3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered	2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 > 3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst	2.00	EA	33	1	39	0	73
M MIL AA <15061 1609 > 4"(10cm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	6.00	LF	35	1	48	1	84
M MIL AA <15185 1009 > 4"D Pipe,1" Thk Fbgs Pipe Cover w/Fire Retardant Jackets	6.00	LF	12	0	19	0	32

2.09. HVAC	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15061 2388 > 4" Thread-O-Let, 300# Forge Stl	3.00	EA	117	8	312	11	440
M MIL AA <15083 1103 > 3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends	1.00	EA	44	0	19	0	64
M MIL AA <15125 2001 > 3/4"Float&Tstat Steam Trap,15PSI	1.00	EA	64	1	28	0	92
M MIL AA <15061 1822 > 3/4" Union, 150# MI Black	4.00	EA	5	2	64	1	70
M MIL AA <15855 1134 > 8"x 5' Round Flue/Vent Pipe Galv Dbl Wall Breech/Smoke Pipe	6.00	EA	162	6	246	2	410
M MIL AA <15855 1184 > 8" Round Flue/Vent Pipe Tees Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	45	3	103	1	149
M MIL AA <15855 1214 > 8"Rnd Flue/Vent Adj Roof Flash Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	19	1	33	0	52
M MIL AA <15855 1194 > 8" Round Flue/Vent Top Caps Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	30	1	33	0	63
M MIL AA <15063 1004 > 1"(25mm) Cu Pipe/Tubing Type L Flue Drain	20.00	LF	26	1	57	1	83
M MIL AA <15104 1103 > 1" Threaded Ball Valve, CS Trim Regular Port, Flue Drain	2.00	EA	37	1	47	0	84
M MIL AA <15063 1044 > 1" 90 Degree Elbow, Copper Flue Drain	5.00	EA	4	1	60	1	65
M MIL AA <15063 1006 > 1-1/2"(40mm) Cu Pipe/Tubing Tp L	30.00	LF	67	3	115	1	183
M MIL AA <15185 1005 > 1-1/2"D Pipe,1"Thk Fib Pipe Cvr w/Fire Retardant Jackets	30.00	LF	34	2	83	1	118
M MIL AA <15122 1105 > 1-1/2" x 1-1/2" Brz PRV, Thrd Boiler Relief Valves	2.00	EA	260	2	71	1	332
M MIL AA <15061 1635 > 1-1/2" 90 Deg Ell, 150# MI Black Boiler Relief Valve	2.00	EA	3	1	35	0	38
M MIL AA <15092 1201 > 2.07" ID Steel Pipe Sleeve Roof Pipe Boot	2.00	EA	49	2	79	3	131
M MIL AA <15063 1003 > 3/4"(20mm) Cu Pipe/Tubing Type L Boiler Drain	15.00	LF	14	1	36	0	50
M MIL AA <15063 1043 > 3/4" 90 Degree Elbow, Copper Boiler Drain	4.00	EA	1	1	38	0	40
M MIL AA <15063 1003 > 3/4"(20mm) Cu Pipe/Tubing Type L Boiler Fill	30.00	LF	28	2	72	1	100
M MIL AA <15121 1202 > 3/4"Thrd St Press Regul & Red,IB Sgl Seat,Sprg Load Dir Act Diap Boiler Fill	1.00	EA	102	1	43	0	145
M MIL AA <15104 1102 > 3/4" Thrd Ball Valve, CS Trim Regular Port, Boiler Fill	3.00	EA	42	2	67	1	109
M MIL AA <15083 1103 > 3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends, Boiler Fill	1.00	EA	44	0	19	0	64
M MIL AA <15080 3201 > 3.5"Diameter Dial Pressure Gauge Aluminum Case 0-300PSI Boiler Fill	1.00	EA	57	1	28	0	85
M MIL AA <15122 1102 > 3/4"x3/4"Brz Press Rlf Vlv, Thrd Boiler Fill	1.00	EA	14	1	22	0	36
M MIL AA <15063 1043 > 3/4" 90 Degree Elbow, Copper Boiler Fill	5.00	EA	2	1	48	0	50
M MIL AA <15063 1023 > 3/4" Copper Tee - Straight Sweat Boiler Fill	2.00	EA	1	1	29	0	30

2.09. HVAC			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15720 2002 >	Duplex Pump & Motor, 1 HP, 25GPM Cnds Pump w/CI Receiver,Float Sw, Condensate Return Pumps		1.00	EA	2,150	13	554	6	2,710
M MIL AA <15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings Condensate Return Pumps		40.00	LF	25	3	107	1	134
M MIL AA <15185 1002 >	3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets		40.00	LF	36	3	102	1	139
M MIL AA <15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered Condensate Return Pumps		2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 >	3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst, Condensate Return Pumps		1.00	EA	17	0	19	0	36
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot		1.00	EA	25	1	40	1	66
M CIV AA <02113 6011 >	Rem 1/2" to 4" D Asb Pipe Insul Air-Cell Glove, Semi-Isolated		5.00	LF	20	1	22	2	44
CIV AA <02111 9202 >	Demo Metal Pipe to 4"(10cm)D Cut piping for connection to existing system (8).		5.00	LF	0	0	19	0	19
M MIL AA <15061 1636 >	2" 90 Degree ELL,150# MI Black For connection to existing system		1.00	EA	2	1	22	0	25
	TOTAL	Steam Distribution Systems			4,320	86	3,631	47	7,998
	TOTAL	Distribution Systems			4,320	86	3,631	47	7,998
	TOTAL	HVAC			20,396	179	7,392	88	27,876
	TOTAL	Bldg. 504 - Fire Station			20,396	179	7,392	88	27,876

3.09. HVAC	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
3. Bldg. 605 - Cons. Public Works							
3.09. HVAC This system includes all equipment, distrbution systems, controls, and energy supply systems required by the heating, ventilating, and air conditioning system.							
3.09.02. Heating Generating Systems This subsystem includes steam, hot water, furnace, and heater systems. Fuel include coal, oil, gas and electric unless otherwise noted.							
3.09.02.01. Steam Boilers Assemblies include boilers, expansion tanks, chemical feeders, air separators, pumps, heat exchangers, boiler feed units, etc. This assembly would also include fittings and specialties and the flue stack. The unit of measure at the assembly level is each.							
M MIL AA <15624 1011 > 1596 MBH Oil Fired H2O Tube Blr Stl Shell w/Insul Jacket & Ctrls	2.00	EA	30,273	229	9,382	706	40,361
TOTAL Steam Boilers			30,273	229	9,382	706	40,361
TOTAL Heating Generating Systems			30,273	229	9,382	706	40,361
3.09.04. Distribution Systems This includes systems that distribute heated and cooled air, ventilating and exhaust air, hot and chilled water, steam, and glycol heating.							
3.09.04.02. Steam Distribution Systems Assemblies include pipe and fitting, including supports, wall and floor sleeves, and pipe insulation. The unit of measure at the assembly level is MBH.							
M MIL AA <15061 1608 > 3"(80mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	20.00	LF	77	3	139	1	217
M MIL AA <15185 1008 > 3"D Pipe,1" Thk Fbgs Pipe Cover w/Fire Retardant Jackets	20.00	LF	31	2	60	1	92
M MIL AA <15101 1304 > 3" Iron Body Gate Valve, Thrd 125# Bronze Mtd w/Threaded Valve	3.00	EA	476	5	206	2	684
M MIL AA <15061 1638 > 3" 90 Degree Ell,150# MI Black	6.00	EA	46	6	263	2	311
M MIL AA <15061 1698 > 3" Tee, Red Out 150# MI Black	1.00	EA	12	1	52	0	64
M MIL AA <15061 1602 > 3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	10.00	LF	6	1	27	0	33
M MIL AA <15185 1002 > 3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets	10.00	LF	9	1	25	0	35
M MIL AA <15101 1104 > 3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered	2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 > 3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst	2.00	EA	33	1	39	0	73
M MIL AA <15061 1612 > 6"(15cm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	6.00	LF	57	2	73	1	131
M MIL AA <15185 1011 > 6"D Pipe,1-1/2"Thk Fbgs Pipe Cvr w/Fire Retardant Jackets	6.00	LF	12	1	25	0	37

3.09. HVAC		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
B MIL AA <15061 2388 >	6" Thread-O-Let, 300# Forge Stl Added 20% for 6" fixture	3.00	EA	140	9	375	13	529
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends	1.00	EA	44	0	19	0	64
M MIL AA <15125 2001 >	3/4"Float&Tstat Steam Trap,15PSI	1.00	EA	64	1	28	0	92
M MIL AA <15061 1822 >	3/4" Union, 150# MI Black	4.00	EA	5	2	64	1	70
M MIL AA <15855 1145 >	12"x 3' Round Flue/Vent Pipe Galv Dbl Wall Breech/Smoke Pipe	10.00	EA	469	8	328	3	800
M MIL AA <15855 1186 >	12" Round Flue/Vent Pipe Tees Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	137	4	166	2	305
M MIL AA <15855 1216 >	12"Rnd Flue/Vent Adj Roof Flash Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	35	1	55	1	91
M MIL AA <15855 1196 >	12" Round Flue/Vent Top Caps Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	109	1	55	1	165
M MIL AA <15063 1004 >	1"(25mm) Cu Pipe/Tubing Type L Flue Drain	20.00	LF	26	1	57	1	83
M MIL AA <15104 1103 >	1" Threaded Ball Valve, CS Trim Regular Port, Flue Drain	2.00	EA	37	1	47	0	84
M MIL AA <15063 1044 >	1" 90 Degree Elbow, Copper Flue Drain	5.00	EA	4	1	60	1	65
M MIL AA <15063 1006 >	1-1/2"(40mm) Cu Pipe/Tubing Tp L	30.00	LF	67	3	115	1	183
M MIL AA <15185 1005 >	1-1/2"D Pipe,1"Thk Fib Pipe Cvr w/Fire Retardant Jackets	30.00	LF	34	2	83	1	118
M MIL AA <15122 1105 >	1-1/2" x 1-1/2" Brz PRV, Thrd Boiler Relief Valves	2.00	EA	260	2	71	1	332
M MIL AA <15061 1635 >	1-1/2" 90 Deg Ell, 150# MI Black Boiler Relief Valve	2.00	EA	3	1	35	0	38
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot	2.00	EA	49	2	79	3	131
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Drain	15.00	LF	14	1	36	0	50
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Drain	4.00	EA	1	1	38	0	40
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Fill	30.00	LF	28	2	72	1	100
M MIL AA <15121 1202 >	3/4"Thrd St Press Regul & Red,IB Sgl Seat,Sprg Load Dir Act Diap Boiler Fill	1.00	EA	102	1	43	0	145
M MIL AA <15104 1102 >	3/4" Thrd Ball Valve, CS Trim Regular Port, Boiler Fill	3.00	EA	42	2	67	1	109
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends, Boiler Fill	1.00	EA	44	0	19	0	64
M MIL AA <15080 3201 >	3.5"Diameter Dial Pressure Gauge Aluminum Case 0-300PSI Boiler Fill	1.00	EA	57	1	28	0	85
M MIL AA <15122 1102 >	3/4"x3/4"Brz Press Rlf Vlv, Thrd Boiler Fill	1.00	EA	14	1	22	0	36
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Fill	5.00	EA	2	1	48	0	50
M MIL AA <15063 1023 >	3/4" Copper Tee - Straight Sweat Boiler Fill	2.00	EA	1	1	29	0	30

3.09. HVAC			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15720 2002 >	Duplex Pump & Motor, 1 HP, 25GPM Cnds Pump w/CI Receiver,Float Sw, Condensate Return Pumps		1.00	EA	2,150	13	554	6	2,710
M MIL AA <15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings Condensate Return Pumps		40.00	LF	25	3	107	1	134
M MIL AA <15185 1002 >	3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets		40.00	LF	36	3	102	1	139
M MIL AA <15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered Condensate Return Pumps		2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 >	3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst, Condensate Return Pumps		1.00	EA	17	0	19	0	36
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot		1.00	EA	25	1	40	1	66
M CIV AA <02113 6011 >	Rem 1/2" to 4" D Asb Pipe Insul Air-Cell Glove, Semi-Isolated		5.00	LF	20	1	22	2	44
CIV AA <02111 9202 >	Demo Metal Pipe to 4"(10cm)D Cut piping for connection to existing system (8).		5.00	LF	0	0	19	0	19
M MIL AA <15061 1636 >	2" 90 Degree ELL,150# MI Black For connection to existing system		1.00	EA	2	1	22	0	25
	TOTAL	Steam Distribution Systems			4,861	93	3,912	51	8,824
	TOTAL	Distribution Systems			4,861	93	3,912	51	8,824
	TOTAL	HVAC			35,134	322	13,294	758	49,185
	TOTAL	Bldg. 605 - Cons. Public Works			35,134	322	13,294	758	49,185

4.09. HVAC	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
4. Bldg. 615 - Motor Pool							
4.09. HVAC This system includes all equipment, distrbution systems, controls, and energy supply systems required by the heating, ventilating, and air conditioning system.							
4.09.02. Heating Generating Systems This subsystem includes steam, hot water, furnace, and heater systems. Fuel include coal, oil, gas and electric unless otherwise noted.							
4.09.02.01. Steam Boilers Assemblies include boilers, expansion tanks, chemical feeders, air separators, pumps, heat exchangers, boiler feed units, etc. This assembly would also include fittings and specialties and the flue stack. The unit of measure at the assembly level is each.							
M MIL AA <15624 1008 > 1274 MBH Oil Fired H2O Tube Blr Stl Shell w/Insul Jacket & Ctrls	2.00	EA	21,890	172	7,036	530	29,456
TOTAL Steam Boilers			21,890	172	7,036	530	29,456
TOTAL Heating Generating Systems			21,890	172	7,036	530	29,456
4.09.04. Distribution Systems This includes systems that distribute heated and cooled air, ventilating and exhaust air, hot and chilled water, steam, and glycol heating.							
4.09.04.02. Steam Distribution Systems Assemblies include pipe and fitting, including supports, wall and floor sleeves, and pipe insulation. The unit of measure at the assembly level is MBH.							
M MIL AA <15061 1608 > 3"(80mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	20.00	LF	77	3	139	1	217
M MIL AA <15185 1008 > 3"D Pipe,1" Thk Fbgs Pipe Cover w/Fire Retardant Jackets	20.00	LF	31	2	60	1	92
M MIL AA <15101 1304 > 3" Iron Body Gate Valve, Thrd 125# Bronze Mtd w/Threaded Valve	3.00	EA	476	5	206	2	684
M MIL AA <15061 1638 > 3" 90 Degree Ell,150# MI Black	6.00	EA	46	6	263	2	311
M MIL AA <15061 1698 > 3" Tee, Red Out 150# MI Black	1.00	EA	12	1	52	0	64
M MIL AA <15061 1602 > 3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	10.00	LF	6	1	27	0	33
M MIL AA <15185 1002 > 3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets	10.00	LF	9	1	25	0	35
M MIL AA <15101 1104 > 3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered	2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 > 3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst	2.00	EA	33	1	39	0	73
M MIL AA <15061 1612 > 6"(15cm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	6.00	LF	57	2	73	1	131
M MIL AA <15185 1011 > 6"D Pipe,1-1/2"Thk Fbgs Pipe Cvr w/Fire Retardant Jackets	6.00	LF	12	1	25	0	37

4.09. HVAC

		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
B MIL AA <15061 2388 >	6" Thread-O-Let, 300# Forge Stl 20% added for 6" fitting	3.00	EA	140	9	375	13	529
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends	1.00	EA	44	0	19	0	64
M MIL AA <15125 2001 >	3/4"Float&Tstat Steam Trap,15PSI	1.00	EA	64	1	28	0	92
M MIL AA <15061 1822 >	3/4" Union, 150# MI Black	4.00	EA	5	2	64	1	70
M MIL AA <15855 1145 >	12"x 3' Round Flue/Vent Pipe Galv Dbl Wall Breech/Smoke Pipe	10.00	EA	469	8	328	3	800
M MIL AA <15855 1186 >	12" Round Flue/Vent Pipe Tees Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	137	4	166	2	305
M MIL AA <15855 1216 >	12"Rnd Flue/Vent Adj Roof Flash Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	35	1	55	1	91
M MIL AA <15855 1196 >	12" Round Flue/Vent Top Caps Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	109	1	55	1	165
M MIL AA <15063 1004 >	1"(25mm) Cu Pipe/Tubing Type L Flue Drain	20.00	LF	26	1	57	1	83
M MIL AA <15104 1103 >	1" Threaded Ball Valve, CS Trim Regular Port, Flue Drain	2.00	EA	37	1	47	0	84
M MIL AA <15063 1044 >	1" 90 Degree Elbow, Copper Flue Drain	5.00	EA	4	1	60	1	65
M MIL AA <15063 1006 >	1-1/2"(40mm) Cu Pipe/Tubing Tp L	30.00	LF	67	3	115	1	183
M MIL AA <15185 1005 >	1-1/2"D Pipe,1"Thk Fib Pipe Cvr w/Fire Retardant Jackets	30.00	LF	34	2	83	1	118
M MIL AA <15122 1105 >	1-1/2" x 1-1/2" Brz PRV, Thrd Boiler Relief Valves	2.00	EA	260	2	71	1	332
M MIL AA <15061 1635 >	1-1/2" 90 Deg Ell, 150# MI Black Boiler Relief Valve	2.00	EA	3	1	35	0	38
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot	2.00	EA	49	2	79	3	131
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Drain	15.00	LF	14	1	36	0	50
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Drain	4.00	EA	1	1	38	0	40
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Fill	30.00	LF	28	2	72	1	100
M MIL AA <15121 1202 >	3/4"Thrd St Press Regul & Red,IB Sgl Seat,Sprg Load Dir Act Diap Boiler Fill	1.00	EA	102	1	43	0	145
M MIL AA <15104 1102 >	3/4" Thrd Ball Valve, CS Trim Regular Port, Boiler Fill	3.00	EA	42	2	67	1	109
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends, Boiler Fill	1.00	EA	44	0	19	0	64
M MIL AA <15080 3201 >	3.5"Diameter Dial Pressure Gauge Aluminum Case 0-300PSI Boiler Fill	1.00	EA	57	1	28	0	85
M MIL AA <15122 1102 >	3/4"x3/4"Brz Press Rlf Vlv, Thrd Boiler Fill	1.00	EA	14	1	22	0	36
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Fill	5.00	EA	2	1	48	0	50
M MIL AA <15063 1023 >	3/4" Copper Tee - Straight Sweat Boiler Fill	2.00	EA	1	1	29	0	30

4.09. HVAC			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA	<15720 2002 >	Duplex Pump & Motor, 1 HP, 25GPM Cnds Pump w/CI Receiver,Float Sw, Condensate Return Pumps	1.00	EA	2,150	13	554	6	2,710
M MIL AA	<15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings Condensate Return Pumps	40.00	LF	25	3	107	1	134
M MIL AA	<15185 1002 >	3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets	40.00	LF	36	3	102	1	139
M MIL AA	<15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered Condensate Return Pumps	2.00	EA	18	1	39	0	58
M MIL AA	<15111 1105 >	3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst, Condensate Return Pumps	1.00	EA	17	0	19	0	36
M MIL AA	<15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot	1.00	EA	25	1	40	1	66
M CIV AA	<02113 6011 >	Rem 1/2" to 4" D Asb Pipe Insul Air-Cell Glove, Semi-Isolated	5.00	LF	20	1	22	2	44
CIV AA	<02111 9202 >	Demo Metal Pipe to 4"(10cm)D Cut piping for connection to existing system (8).	5.00	LF	0	0	19	0	19
M MIL AA	<15061 1636 >	2" 90 Degree ELL,150# MI Black For connection to existing system	1.00	EA	2	1	22	0	25
		TOTAL Steam Distribution Systems			4,861	93	3,912	51	8,824
		TOTAL Distribution Systems			4,861	93	3,912	51	8,824
		TOTAL HVAC			26,751	265	10,948	581	38,280
		TOTAL Bldg. 615 - Motor Pool			26,751	265	10,948	581	38,280

5.09. HVAC	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
5. Bldg. 725 - School							
5.09. HVAC This system includes all equipment, distrbution systems, controls, and energy supply systems required by the heating, ventilating, and air conditioning system.							
5.09.02. Heating Generating Systems This subsystem includes steam, hot water, furnace, and heater systems. Fuel include coal, oil, gas and electric unless otherwise noted.							
5.09.02.01. Steam Boilers Assemblies include boilers, expansion tanks, chemical feeders, air separators, pumps, heat exchangers, boiler feed units, etc. This assembly would also include fittings and specialties and the flue stack. The unit of measure at the assembly level is each.							
M USR AA <15624 1015 > 3150 MBH Oil Fired H2O Tube Blr Stl Shell w/Insul Jacket & Ctrls. Price taken from 1996 Means Mechanical, increased for Alaska costs.	2.00	EA	66,620	307	12,565	946	80,131
TOTAL Steam Boilers			66,620	307	12,565	946	80,131
TOTAL Heating Generating Systems			66,620	307	12,565	946	80,131
5.09.04. Distribution Systems This includes systems that distribute heated and cooled air, ventilating and exhaust air, hot and chilled water, steam, and glycol heating.							
5.09.04.02. Steam Distribution Systems Assemblies include pipe and fitting, including supports, wall and floor sleeves, and pipe insulation. The unit of measure at the assembly level is MBH.							
M MIL AA <15061 1609 > 4"(10cm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	20.00	LF	117	4	161	2	280
M MIL AA <15185 1009 > 4"D Pipe,1" Thk Fbgs Pipe Cover w/Fire Retardant Jackets	20.00	LF	40	2	65	1	105
M MIL AA <15101 1305 > 4" Iron Body Gate Valve, Thrd 125# Bronze Mtd w/Threaded Valve	3.00	EA	1,281	5	224	2	1,507
M MIL AA <15061 1639 > 4" 90 Degree Ell,150# MI Black	6.00	EA	97	7	282	3	382
M MIL AA <15061 1699 > 4" Tee, Red Out 150# MI Black	1.00	EA	23	1	59	1	83
M MIL AA <15061 1602 > 3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	10.00	LF	6	1	27	0	33
M MIL AA <15185 1002 > 3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets	10.00	LF	9	1	25	0	35
M MIL AA <15101 1104 > 3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered	2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 > 3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst	2.00	EA	33	1	39	0	73

5.09. HVAC			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15061 2306 >	8"(20cm) Black Pipe,PE Sch40 A53		6.00	LF	46	2	96	6	148
M MIL AA <15185 1012 >	8"D Pipe, 2" Thk Fbgs Pipe Cover w/Fire Retardant Jackets		6.00	LF	38	1	32	0	70
B MIL AA <15061 2388 >	8" Thread-O-Let, 300# Forge Stl Add 40% for 8" fitting		3.00	EA	169	11	450	16	634
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends		1.00	EA	44	0	19	0	64
M MIL AA <15125 2001 >	3/4"Float&Tstat Steam Trap,15PSI		1.00	EA	64	1	28	0	92
M MIL AA <15061 1822 >	3/4" Union, 150# MI Black		4.00	EA	5	2	64	1	70
M MIL AA <15855 1152 >	18"x 3' Round Flue/Vent Pipe Galv Dbl Wall Breech/Smoke Pipe		10.00	EA	1,340	11	456	4	1,800
M MIL AA <15855 1188 >	18" Round Flue/Vent Pipe Tees Galv Dbl Wall Breech/Smoke Pipe		2.00	EA	407	6	231	2	641
M MIL AA <15855 1218 >	18"Rnd Flue/Vent Adj Roof Flash Galv Dbl Wall Breech/Smoke Pipe		2.00	EA	129	2	78	1	208
M MIL AA <15855 1198 >	18" Round Flue/Vent Top Caps Galv Dbl Wall Breech/Smoke Pipe		2.00	EA	332	2	78	1	411
M MIL AA <15063 1004 >	1"(25mm) Cu Pipe/Tubing Type L Flue Drain		20.00	LF	26	1	57	1	83
M MIL AA <15104 1103 >	1" Threaded Ball Valve, CS Trim Regular Port, Flue Drain		2.00	EA	37	1	47	0	84
M MIL AA <15063 1044 >	1" 90 Degree Elbow, Copper Flue Drain		5.00	EA	4	1	60	1	65
M MIL AA <15063 1006 >	1-1/2"(40mm) Cu Pipe/Tubing Tp L		30.00	LF	67	3	115	1	183
M MIL AA <15185 1005 >	1-1/2"D Pipe,1"Thk Fib Pipe Cvr w/Fire Retardant Jackets		30.00	LF	34	2	83	1	118
M MIL AA <15122 1105 >	1-1/2" x 1-1/2" Brz PRV, Thrd Boiler Relief Valves		2.00	EA	260	2	71	1	332
M MIL AA <15061 1635 >	1-1/2" 90 Deg Ell, 150# MI Black Boiler Relief Valve		2.00	EA	3	1	35	0	38
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot		2.00	EA	49	2	79	3	131
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Drain		15.00	LF	14	1	36	0	50
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Drain		4.00	EA	1	1	38	0	40
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Fill		30.00	LF	28	2	72	1	100
M MIL AA <15121 1202 >	3/4"Thrd St Press Regul & Red,IB Sgl Seat,Sprg Load Dir Act Diap Boiler Fill		1.00	EA	102	1	43	0	145
M MIL AA <15104 1102 >	3/4" Thrd Ball Valve, CS Trim Regular Port, Boiler Fill		3.00	EA	42	2	67	1	109
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends, Boiler Fill		1.00	EA	44	0	19	0	64
M MIL AA <15080 3201 >	3.5"Diameter Dial Pressure Gauge Aluminum Case 0-300PSI Boiler Fill		1.00	EA	57	1	28	0	85
M MIL AA <15122 1102 >	3/4"x3/4"Brz Press Rlf Vlv, Thrd Boiler Fill		1.00	EA	14	1	22	0	36

5.09. HVAC			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Fill		5.00	EA	2	1	48	0	50
M MIL AA <15063 1023 >	3/4" Copper Tee - Straight Sweat Boiler Fill		2.00	EA	1	1	29	0	30
M MIL AA <15720 2002 >	Duplex Pump & Motor, 1 HP, 25GPM Cnds Pump w/CI Receiver,Float Sw, Condensate Return Pumps		1.00	EA	2,150	13	554	6	2,710
M MIL AA <15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings Condensate Return Pumps		40.00	LF	25	3	107	1	134
M MIL AA <15185 1002 >	3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets		40.00	LF	36	3	102	1	139
M MIL AA <15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered Condensate Return Pumps		2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 >	3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst, Condensate Return Pumps		1.00	EA	17	0	19	0	36
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot		1.00	EA	25	1	40	1	66
M CIV AA <02113 6011 >	Rem 1/2" to 4" D Asb Pipe Insul Air-Cell Glove, Semi-Isolated		5.00	LF	20	1	22	2	44
CIV AA <02111 9202 >	Demo Metal Pipe to 4"(10cm)D Cut piping for connection to existing system (8).		5.00	LF	0	0	19	0	19
M MIL AA <15061 1636 >	2" 90 Degree ELL,150# MI Black For connection to existing system		1.00	EA	2	1	22	0	25
	TOTAL	Steam Distribution Systems			7,278	103	4,328	63	11,669
	TOTAL	Distribution Systems			7,278	103	4,328	63	11,669
	TOTAL	HVAC			73,898	410	16,893	1,009	91,799
	TOTAL	Bldg. 725 - School			73,898	410	16,893	1,009	91,799

6.09. HVAC	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
6. Bldg. 820 - Housing							
6.09. HVAC This system includes all equipment, distrbution systems, controls, and energy supply systems required by the heating, ventilating, and air conditioning system.							
6.09.02. Heating Generating Systems This subsystem includes steam, hot water, furnace, and heater systems. Fuel include coal, oil, gas and electric unless otherwise noted.							
6.09.02.01. Steam Boilers Assemblies include boilers, expansion tanks, chemical feeders, air separators, pumps, heat exchangers, boiler feed units, etc. This assembly would also include fittings and specialties and the flue stack. The unit of measure at the assembly level is each.							
M MIL AA <15624 1008 > 1120 MBH Oil Fired H2O Tube Blr Stl Shell w/Insul Jacket & Ctrls	2.00	EA	21,890	172	7,036	530	29,456
TOTAL Steam Boilers			21,890	172	7,036	530	29,456
TOTAL Heating Generating Systems			21,890	172	7,036	530	29,456
6.09.04. Distribution Systems This includes systems that distribute heated and cooled air, ventilating and exhaust air, hot and chilled water, steam, and glycol heating.							
6.09.04.02. Steam Distribution Systems Assemblies include pipe and fitting, including supports, wall and floor sleeves, and pipe insulation. The unit of measure at the assembly level is MBH.							
M MIL AA <15061 1608 > 3"(80mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	20.00	LF	77	3	139	1	217
M MIL AA <15185 1008 > 3"D Pipe,1" Thk Fbgs Pipe Cover w/Fire Retardant Jackets	20.00	LF	31	2	60	1	92
M MIL AA <15101 1304 > 3" Iron Body Gate Valve, Thrd 125# Bronze Mtd w/Threaded Valve	3.00	EA	476	5	206	2	684
M MIL AA <15061 1638 > 3" 90 Degree Ell,150# MI Black	6.00	EA	46	6	263	2	311
M MIL AA <15061 1698 > 3" Tee, Red Out 150# MI Black	1.00	EA	12	1	52	0	64
M MIL AA <15061 1602 > 3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	10.00	LF	6	1	27	0	33
M MIL AA <15185 1002 > 3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets	10.00	LF	9	1	25	0	35
M MIL AA <15101 1104 > 3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered	2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 > 3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst	2.00	EA	33	1	39	0	73
M MIL AA <15061 1612 > 6"(15cm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	6.00	LF	57	2	73	1	131
M MIL AA <15185 1011 > 6"D Pipe,1-1/2"Thk Fbgs Pipe Cvr w/Fire Retardant Jackets	6.00	LF	12	1	25	0	37

6.09. HVAC

		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
B MIL AA <15061 2388 >	6" Thread-O-Let, 300# Forge Stl Add 20% for 6" fitting	3.00	EA	140	9	375	13	529
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends	1.00	EA	44	0	19	0	64
M MIL AA <15125 2001 >	3/4"Float&Tstat Steam Trap,15PSI	1.00	EA	64	1	28	0	92
M MIL AA <15061 1822 >	3/4" Union, 150# MI Black	4.00	EA	5	2	64	1	70
M MIL AA <15855 1142 >	10"x 3' Round Flue/Vent Pipe Galv Dbl Wall Breech/Smoke Pipe	10.00	EA	338	7	304	3	645
M MIL AA <15855 1185 >	10" Round Flue/Vent Pipe Tees Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	115	3	137	1	253
M MIL AA <15855 1215 >	10"Rnd Flue/Vent Adj Roof Flash Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	27	1	44	0	72
M MIL AA <15855 1195 >	10" Round Flue/Vent Top Caps Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	77	1	44	0	122
M MIL AA <15063 1004 >	1"(25mm) Cu Pipe/Tubing Type L Flue Drain	20.00	LF	26	1	57	1	83
M MIL AA <15104 1103 >	1" Threaded Ball Valve, CS Trim Regular Port, Flue Drain	2.00	EA	37	1	47	0	84
M MIL AA <15063 1044 >	1" 90 Degree Elbow, Copper Flue Drain	5.00	EA	4	1	60	1	65
M MIL AA <15063 1006 >	1-1/2"(40mm) Cu Pipe/Tubing Tp L	30.00	LF	67	3	115	1	183
M MIL AA <15185 1005 >	1-1/2"D Pipe,1"Thk Fib Pipe Cvr w/Fire Retardant Jackets	30.00	LF	34	2	83	1	118
M MIL AA <15122 1105 >	1-1/2" x 1-1/2" Brz PRV, Thrd Boiler Relief Valves	2.00	EA	260	2	71	1	332
M MIL AA <15061 1635 >	1-1/2" 90 Deg Ell, 150# MI Black Boiler Relief Valve	2.00	EA	3	1	35	0	38
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot	2.00	EA	49	2	79	3	131
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Drain	15.00	LF	14	1	36	0	50
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Drain	4.00	EA	1	1	38	0	40
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Fill	30.00	LF	28	2	72	1	100
M MIL AA <15121 1202 >	3/4"Thrd St Press Regul & Red,IB Sgl Seat,Sprg Load Dir Act Diap Boiler Fill	1.00	EA	102	1	43	0	145
M MIL AA <15104 1102 >	3/4" Thrd Ball Valve, CS Trim Regular Port, Boiler Fill	3.00	EA	42	2	67	1	109
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends, Boiler Fill	1.00	EA	44	0	19	0	64
M MIL AA <15080 3201 >	3.5"Diameter Dial Pressure Gauge Aluminum Case 0-300PSI Boiler Fill	1.00	EA	57	1	28	0	85
M MIL AA <15122 1102 >	3/4"x3/4"Brz Press Rlf Vlv, Thrd Boiler Fill	1.00	EA	14	1	22	0	36
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Fill	5.00	EA	2	1	48	0	50
M MIL AA <15063 1023 >	3/4" Copper Tee - Straight Sweat Boiler Fill	2.00	EA	1	1	29	0	30

6.09. HVAC			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15720 2002 >	Duplex Pump & Motor, 1 HP, 25GPM Cnds Pump w/CI Receiver,Float Sw, Condensate Return Pumps		1.00	EA	2,150	13	554	6	2,710
M MIL AA <15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings Condensate Return Pumps		40.00	LF	25	3	107	1	134
M MIL AA <15185 1002 >	3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets		40.00	LF	36	3	102	1	139
M MIL AA <15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered Condensate Return Pumps		2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 >	3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst, Condensate Return Pumps		1.00	EA	17	0	19	0	36
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot		1.00	EA	25	1	40	1	66
M CIV AA <02113 6011 >	Rem 1/2" to 4" D Asb Pipe Insul Air-Cell Glove, Semi-Isolated		5.00	LF	20	1	22	2	44
CIV AA <02111 9202 >	Demo Metal Pipe to 4"(10cm)D Cut piping for connection to existing system (8).		5.00	LF	0	0	19	0	19
M MIL AA <15061 1636 >	2" 90 Degree ELL,150# MI Black For connection to existing system		1.00	EA	2	1	22	0	25
	TOTAL	Steam Distribution Systems			4,667	91	3,838	50	8,555
	TOTAL	Distribution Systems			4,667	91	3,838	50	8,555
	TOTAL	HVAC			26,557	263	10,874	580	38,011
	TOTAL	Bldg. 820 - Housing			26,557	263	10,874	580	38,011

7.09. HVAC	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
7. Bldg. 821 - Housing							
7.09. HVAC This system includes all equipment, distrbution systems, controls, and energy supply systems required by the heating, ventilating, and air conditioning system.							
7.09.02. Heating Generating Systems This subsystem includes steam, hot water, furnace, and heater systems. Fuel include coal, oil, gas and electric unless otherwise noted.							
7.09.02.01. Steam Boilers Assemblies include boilers, expansion tanks, chemical feeders, air separators, pumps, heat exchangers, boiler feed units, etc. This assembly would also include fittings and specialties and the flue stack. The unit of measure at the assembly level is each.							
M MIL AA <15624 1008 > 1120 MBH Oil Fired H2O Tube Blr Stl Shell w/Insul Jacket & Ctrls	2.00	EA	21,890	172	7,036	530	29,456
TOTAL Steam Boilers			21,890	172	7,036	530	29,456
TOTAL Heating Generating Systems			21,890	172	7,036	530	29,456
7.09.04. Distribution Systems This includes systems that distribute heated and cooled air, ventilating and exhaust air, hot and chilled water, steam, and glycol heating.							
7.09.04.02. Steam Distribution Systems Assemblies include pipe and fitting, including supports, wall and floor sleeves, and pipe insulation. The unit of measure at the assembly level is MBH.							
M MIL AA <15061 1608 > 3"(80mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	20.00	LF	77	3	139	1	217
M MIL AA <15185 1008 > 3"D Pipe,1" Thk Fbgs Pipe Cover w/Fire Retardant Jackets	20.00	LF	31	2	60	1	92
M MIL AA <15101 1304 > 3" Iron Body Gate Valve, Thrd 125# Bronze Mtd w/Threaded Valve	3.00	EA	476	5	206	2	684
M MIL AA <15061 1638 > 3" 90 Degree Ell,150# MI Black	6.00	EA	46	6	263	2	311
M MIL AA <15061 1698 > 3" Tee, Red Out 150# MI Black	1.00	EA	12	1	52	0	64
M MIL AA <15061 1602 > 3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	10.00	LF	6	1	27	0	33
M MIL AA <15185 1002 > 3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets	10.00	LF	9	1	25	0	35
M MIL AA <15101 1104 > 3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered	2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 > 3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst	2.00	EA	33	1	39	0	73
M MIL AA <15061 1612 > 6"(15cm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	6.00	LF	57	2	73	1	131
M MIL AA <15185 1011 > 6"D Pipe,1-1/2"Thk Fbgs Pipe Cvr w/Fire Retardant Jackets	6.00	LF	12	1	25	0	37

7.09. HVAC

		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
B MIL AA <15061 2388 >	6" Thread-O-Let, 300# Forge Stl 20% added for 6" fitting	3.00	EA	140	9	375	13	529
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends	1.00	EA	44	0	19	0	64
M MIL AA <15125 2001 >	3/4"Float&Tstat Steam Trap,15PSI	1.00	EA	64	1	28	0	92
M MIL AA <15061 1822 >	3/4" Union, 150# MI Black	4.00	EA	5	2	64	1	70
M MIL AA <15855 1142 >	10"x 3' Round Flue/Vent Pipe Galv Dbl Wall Breech/Smoke Pipe	10.00	EA	338	7	304	3	645
M MIL AA <15855 1185 >	10" Round Flue/Vent Pipe Tees Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	115	3	137	1	253
M MIL AA <15855 1215 >	10"Rnd Flue/Vent Adj Roof Flash Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	27	1	44	0	72
M MIL AA <15855 1195 >	10" Round Flue/Vent Top Caps Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	77	1	44	0	122
M MIL AA <15063 1004 >	1"(25mm) Cu Pipe/Tubing Type L Flue Drain	20.00	LF	26	1	57	1	83
M MIL AA <15104 1103 >	1" Threaded Ball Valve, CS Trim Regular Port, Flue Drain	2.00	EA	37	1	47	0	84
M MIL AA <15063 1044 >	1" 90 Degree Elbow, Copper Flue Drain	5.00	EA	4	1	60	1	65
M MIL AA <15063 1006 >	1-1/2"(40mm) Cu Pipe/Tubing Tp L	30.00	LF	67	3	115	1	183
M MIL AA <15185 1005 >	1-1/2"D Pipe,1"Thk Fib Pipe Cvr w/Fire Retardant Jackets	30.00	LF	34	2	83	1	118
M MIL AA <15122 1105 >	1-1/2" x 1-1/2" Brz PRV, Thrd Boiler Relief Valves	2.00	EA	260	2	71	1	332
M MIL AA <15061 1635 >	1-1/2" 90 Deg Ell, 150# MI Black Boiler Relief Valve	2.00	EA	3	1	35	0	38
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot	2.00	EA	49	2	79	3	131
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Drain	15.00	LF	14	1	36	0	50
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Drain	4.00	EA	1	1	38	0	40
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Fill	30.00	LF	28	2	72	1	100
M MIL AA <15121 1202 >	3/4"Thrd St Press Regul & Red,IB Sgl Seat,Sprg Load Dir Act Diap Boiler Fill	1.00	EA	102	1	43	0	145
M MIL AA <15104 1102 >	3/4" Thrd Ball Valve, CS Trim Regular Port, Boiler Fill	3.00	EA	42	2	67	1	109
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends, Boiler Fill	1.00	EA	44	0	19	0	64
M MIL AA <15080 3201 >	3.5"Diameter Dial Pressure Gauge Aluminum Case 0-300PSI Boiler Fill	1.00	EA	57	1	28	0	85
M MIL AA <15122 1102 >	3/4"x3/4"Brz Press Rlf Vlv, Thrd Boiler Fill	1.00	EA	14	1	22	0	36
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Fill	5.00	EA	2	1	48	0	50
M MIL AA <15063 1023 >	3/4" Copper Tee - Straight Sweat Boiler Fill	2.00	EA	1	1	29	0	30

7.09. HVAC			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15720 2002 >	Duplex Pump & Motor, 1 HP, 25GPM Cnds Pump w/CI Receiver,Float Sw, Condensate Return Pumps		1.00	EA	2,150	13	554	6	2,710
M MIL AA <15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings Condensate Return Pumps		40.00	LF	25	3	107	1	134
M MIL AA <15185 1002 >	3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets		40.00	LF	36	3	102	1	139
M MIL AA <15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered Condensate Return Pumps		2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 >	3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst, Condensate Return Pumps		1.00	EA	17	0	19	0	36
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot		1.00	EA	25	1	40	1	66
M CIV AA <02113 6011 >	Rem 1/2" to 4" D Asb Pipe Insul Air-Cell Glove, Semi-Isolated		5.00	LF	20	1	22	2	44
CIV AA <02111 9202 >	Demo Metal Pipe to 4"(10cm)D Cut piping for connection to existing system (8).		5.00	LF	0	0	19	0	19
M MIL AA <15061 1636 >	2" 90 Degree ELL,150# MI Black For connection to existing system		1.00	EA	2	1	22	0	25
	TOTAL	Steam Distribution Systems			4,667	91	3,838	50	8,555
	TOTAL	Distribution Systems			4,667	91	3,838	50	8,555
	TOTAL	HVAC			26,557	263	10,874	580	38,011
	TOTAL	Bldg. 821 - Housing			26,557	263	10,874	580	38,011

8.09. HVAC	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
8. Bldg. 606 - Central Heating Plt							
8.09. HVAC This system includes all equipment, distrbution systems, controls, and energy supply systems required by the heating, ventilating, and air conditioning system.							
8.09.02. Heating Generating Systems This subsystem includes steam, hot water, furnace, and heater systems. Fuel include coal, oil, gas and electric unless otherwise noted.							
8.09.02.01. Steam Boilers Assemblies include boilers, expansion tanks, chemical feeders, air separators, pumps, heat exchangers, boiler feed units, etc. This assembly would also include fittings and specialties and the flue stack. The unit of measure at the assembly level is each.							
M MIL AA <15624 1012 > 1960 MBH Oil Fired H2O Tube Blr Stl Shell w/Insul Jacket & Ctrls	2.00	EA	32,031	265	10,825	815	43,671
TOTAL Steam Boilers			32,031	265	10,825	815	43,671
TOTAL Heating Generating Systems			32,031	265	10,825	815	43,671
8.09.04. Distribution Systems This includes systems that distribute heated and cooled air, ventilating and exhaust air, hot and chilled water, steam, and glycol heating.							
8.09.04.02. Steam Distribution Systems Assemblies include pipe and fitting, including supports, wall and floor sleeves, and pipe insulation. The unit of measure at the assembly level is MBH.							
M MIL AA <15061 1608 > 3"(80mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	20.00	LF	77	3	139	1	217
M MIL AA <15185 1008 > 3"D Pipe,1" Thk Fbgs Pipe Cover w/Fire Retardant Jackets	20.00	LF	31	2	60	1	92
M MIL AA <15101 1304 > 3" Iron Body Gate Valve, Thrd 125# Bronze Mtd w/Threaded Valve	3.00	EA	476	5	206	2	684
M MIL AA <15061 1638 > 3" 90 Degree Ell,150# MI Black	6.00	EA	46	6	263	2	311
M MIL AA <15061 1698 > 3" Tee, Red Out 150# MI Black	1.00	EA	12	1	52	0	64
M MIL AA <15061 1612 > 6"(15cm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	6.00	LF	57	2	73	1	131
M MIL AA <15185 1011 > 6"D Pipe,1-1/2"Thk Fbgs Pipe Cvr w/Fire Retardant Jackets	6.00	LF	12	1	25	0	37
B MIL AA <15061 2388 > 6" Thread-O-Let, 300# Forge Stl 20% added for 6" fitting	3.00	EA	140	9	375	13	529
M MIL AA <15083 1103 > 3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends	1.00	EA	44	0	19	0	64
M MIL AA <15125 2001 > 3/4"Float&Tstat Steam Trap,15PSI	1.00	EA	64	1	28	0	92
M MIL AA <15061 1822 > 3/4" Union, 150# MI Black	4.00	EA	5	2	64	1	70
M MIL AA <15185 1002 > 3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets	10.00	LF	9	1	25	0	35

8.09. HVAC

		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	10.00	LF	6	1	27	0	33
M MIL AA <15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered	2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 >	3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst	2.00	EA	33	1	39	0	73
M MIL AA <15855 1145 >	12"x 3' Round Flue/Vent Pipe Galv Dbl Wall Breech/Smoke Pipe	10.00	EA	469	8	328	3	800
M MIL AA <15855 1186 >	12" Round Flue/Vent Pipe Tees Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	137	4	166	2	305
M MIL AA <15855 1216 >	12"Rnd Flue/Vent Adj Roof Flash Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	35	1	55	1	91
M MIL AA <15855 1196 >	12" Round Flue/Vent Top Caps Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	109	1	55	1	165
M MIL AA <15063 1004 >	1"(25mm) Cu Pipe/Tubing Type L Flue Drain	20.00	LF	26	1	57	1	83
M MIL AA <15104 1103 >	1" Threaded Ball Valve, CS Trim Regular Port, Flue Drain	2.00	EA	37	1	47	0	84
M MIL AA <15063 1044 >	1" 90 Degree Elbow, Copper Flue Drain	5.00	EA	4	1	60	1	65
M MIL AA <15063 1006 >	1-1/2"(40mm) Cu Pipe/Tubing Tp L	30.00	LF	67	3	115	1	183
M MIL AA <15185 1005 >	1-1/2"D Pipe,1"Thk Fib Pipe Cvr w/Fire Retardant Jackets	30.00	LF	34	2	83	1	118
M MIL AA <15122 1105 >	1-1/2" x 1-1/2" Brz PRV, Thrd Boiler Relief Valves	2.00	EA	260	2	71	1	332
M MIL AA <15061 1635 >	1-1/2" 90 Deg Ell, 150# MI Black Boiler Relief Valve	2.00	EA	3	1	35	0	38
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot	2.00	EA	49	2	79	3	131
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Drain	15.00	LF	14	1	36	0	50
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Drain	4.00	EA	1	1	38	0	40
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Fill	30.00	LF	28	2	72	1	100
M MIL AA <15121 1202 >	3/4"Thrd St Press Regul & Red,IB Sgl Seat,Sprg Load Dir Act Diap Boiler Fill	1.00	EA	102	1	43	0	145
M MIL AA <15104 1102 >	3/4" Thrd Ball Valve, CS Trim Regular Port, Boiler Fill	3.00	EA	42	2	67	1	109
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends, Boiler Fill	1.00	EA	44	0	19	0	64
M MIL AA <15080 3201 >	3.5"Diameter Dial Pressure Gauge Aluminum Case 0-300PSI Boiler Fill	1.00	EA	57	1	28	0	85
M MIL AA <15122 1102 >	3/4"x3/4"Brz Press Rlf Vlv, Thrd Boiler Fill	1.00	EA	14	1	22	0	36
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Fill	5.00	EA	2	1	48	0	50
M MIL AA <15063 1023 >	3/4" Copper Tee - Straight Sweat Boiler Fill	2.00	EA	1	1	29	0	30

8.09. HVAC			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15720 2002 >	Duplex Pump & Motor, 1 HP, 25GPM Cnds Pump w/CI Receiver,Float Sw, Condensate Return Pumps		1.00	EA	2,150	13	554	6	2,710
M MIL AA <15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings Condensate Return Pumps		40.00	LF	25	3	107	1	134
M MIL AA <15185 1002 >	3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets		40.00	LF	36	3	102	1	139
M MIL AA <15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered Condensate Return Pumps		2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 >	3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst, Condensate Return Pumps		1.00	EA	17	0	19	0	36
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot		1.00	EA	25	1	40	1	66
M CIV AA <02113 6011 >	Rem 1/2" to 4" D Asb Pipe Insul Air-Cell Glove, Semi-Isolated		5.00	LF	20	1	22	2	44
CIV AA <02111 9202 >	Demo Metal Pipe to 4"(10cm)D Cut piping for connection to existing system (8).		5.00	LF	0	0	19	0	19
M MIL AA <15061 1636 >	2" 90 Degree ELL,150# MI Black For connection to existing system		1.00	EA	2	1	22	0	25
	TOTAL	Steam Distribution Systems			4,861	93	3,912	51	8,824
	TOTAL	Distribution Systems			4,861	93	3,912	51	8,824
	TOTAL	HVAC			36,892	357	14,737	866	52,495
	TOTAL	Bldg. 606 - Central Heating Plt			36,892	357	14,737	866	52,495

9.09. HVAC	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
9. Bldg. 612 - Tank Maintenance							
9.09. HVAC This system includes all equipment, distrbution systems, controls, and energy supply systems required by the heating, ventilating, and air conditioning system.							
9.09.02. Heating Generating Systems This subsystem includes steam, hot water, furnace, and heater systems. Fuel include coal, oil, gas and electric unless otherwise noted.							
9.09.02.01. Steam Boilers Assemblies include boilers, expansion tanks, chemical feeders, air separators, pumps, heat exchangers, boiler feed units, etc. This assembly would also include fittings and specialties and the flue stack. The unit of measure at the assembly level is each.							
M MIL AA <15624 1008 > 1274 MBH Oil Fired H2O Tube Blr Stl Shell w/Insul Jacket & Ctrls	2.00	EA	21,890	172	7,036	530	29,456
TOTAL Steam Boilers			21,890	172	7,036	530	29,456
TOTAL Heating Generating Systems			21,890	172	7,036	530	29,456
9.09.04. Distribution Systems This includes systems that distribute heated and cooled air, ventilating and exhaust air, hot and chilled water, steam, and glycol heating.							
9.09.04.02. Steam Distribution Systems Assemblies include pipe and fitting, including supports, wall and floor sleeves, and pipe insulation. The unit of measure at the assembly level is MBH.							
M MIL AA <15061 1608 > 3"(80mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	20.00	LF	77	3	139	1	217
M MIL AA <15185 1008 > 3"D Pipe,1" Thk Fbgs Pipe Cover w/Fire Retardant Jackets	20.00	LF	31	2	60	1	92
M MIL AA <15101 1304 > 3" Iron Body Gate Valve, Thrd 125# Bronze Mtd w/Threaded Valve	3.00	EA	476	5	206	2	684
M MIL AA <15061 1638 > 3" 90 Degree Ell,150# MI Black	6.00	EA	46	6	263	2	311
M MIL AA <15061 1698 > 3" Tee, Red Out 150# MI Black	1.00	EA	12	1	52	0	64
M MIL AA <15061 1602 > 3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	10.00	LF	6	1	27	0	33
M MIL AA <15185 1002 > 3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets	10.00	LF	9	1	25	0	35
M MIL AA <15101 1104 > 3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered	2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 > 3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst	2.00	EA	33	1	39	0	73
M MIL AA <15061 1612 > 6"(15cm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	6.00	LF	57	2	73	1	131
M MIL AA <15185 1011 > 6"D Pipe,1-1/2"Thk Fbgs Pipe Cvr w/Fire Retardant Jackets	6.00	LF	12	1	25	0	37

9.09. HVAC		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
B MIL AA <15061 2388 >	6" Thread-O-Let, 300# Forge Stl 20% added for 6" fitting	3.00	EA	140	9	375	13	529
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends	1.00	EA	44	0	19	0	64
M MIL AA <15125 2001 >	3/4"Float&Tstat Steam Trap,15PSI	1.00	EA	64	1	28	0	92
M MIL AA <15061 1822 >	3/4" Union, 150# MI Black	4.00	EA	5	2	64	1	70
M MIL AA <15855 1145 >	12"x 3' Round Flue/Vent Pipe Galv Dbl Wall Breech/Smoke Pipe	10.00	EA	469	8	328	3	800
M MIL AA <15855 1186 >	12" Round Flue/Vent Pipe Tees Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	137	4	166	2	305
M MIL AA <15855 1216 >	12"Rnd Flue/Vent Adj Roof Flash Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	35	1	55	1	91
M MIL AA <15855 1196 >	12" Round Flue/Vent Top Caps Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	109	1	55	1	165
M MIL AA <15063 1004 >	1"(25mm) Cu Pipe/Tubing Type L Flue Drain	20.00	LF	26	1	57	1	83
M MIL AA <15104 1103 >	1" Threaded Ball Valve, CS Trim Regular Port, Flue Drain	2.00	EA	37	1	47	0	84
M MIL AA <15063 1044 >	1" 90 Degree Elbow, Copper Flue Drain	5.00	EA	4	1	60	1	65
M MIL AA <15063 1006 >	1-1/2"(40mm) Cu Pipe/Tubing Tp L	30.00	LF	67	3	115	1	183
M MIL AA <15185 1005 >	1-1/2"D Pipe,1"Thk Fib Pipe Cvr w/Fire Retardant Jackets	30.00	LF	34	2	83	1	118
M MIL AA <15122 1105 >	1-1/2" x 1-1/2" Brz PRV, Thrd Boiler Relief Valves	2.00	EA	260	2	71	1	332
M MIL AA <15061 1635 >	1-1/2" 90 Deg Ell, 150# MI Black Boiler Relief Valve	2.00	EA	3	1	35	0	38
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot	2.00	EA	49	2	79	3	131
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Drain	15.00	LF	14	1	36	0	50
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Drain	4.00	EA	1	1	38	0	40
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Fill	30.00	LF	28	2	72	1	100
M MIL AA <15121 1202 >	3/4"Thrd St Press Regul & Red,IB Sgl Seat,Sprg Load Dir Act Diap Boiler Fill	1.00	EA	102	1	43	0	145
M MIL AA <15104 1102 >	3/4" Thrd Ball Valve, CS Trim Regular Port, Boiler Fill	3.00	EA	42	2	67	1	109
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends, Boiler Fill	1.00	EA	44	0	19	0	64
M MIL AA <15080 3201 >	3.5"Diameter Dial Pressure Gauge Aluminum Case 0-300PSI Boiler Fill	1.00	EA	57	1	28	0	85
M MIL AA <15122 1102 >	3/4"x3/4"Brz Press Rlf Vlv, Thrd Boiler Fill	1.00	EA	14	1	22	0	36
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Fill	5.00	EA	2	1	48	0	50
M MIL AA <15063 1023 >	3/4" Copper Tee - Straight Sweat Boiler Fill	2.00	EA	1	1	29	0	30

9.09. HVAC

		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15720 2002 >	Duplex Pump & Motor, 1 HP, 25GPM Cnds Pump w/CI Receiver,Float Sw, Condensate Return Pumps	1.00	EA	2,150	13	554	6	2,710
M MIL AA <15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings Condensate Return Pumps	40.00	LF	25	3	107	1	134
M MIL AA <15185 1002 >	3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets	40.00	LF	36	3	102	1	139
M MIL AA <15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered Condensate Return Pumps	2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 >	3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst, Condensate Return Pumps	1.00	EA	17	0	19	0	36
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot	1.00	EA	25	1	40	1	66
M CIV AA <02113 6011 >	Rem 1/2" to 4" D Asb Pipe Insul Air-Cell Glove, Semi-Isolated	5.00	LF	20	1	22	2	44
CIV AA <02111 9202 >	Demo Metal Pipe to 4"(10cm)D Cut piping for connection to existing system (8).	5.00	LF	0	0	19	0	19
M MIL AA <15061 1636 >	2" 90 Degree ELL,150# MI Black For connection to existing system	1.00	EA	2	1	22	0	25
TOTAL	Steam Distribution Systems			4,861	93	3,912	51	8,824
TOTAL	Distribution Systems			4,861	93	3,912	51	8,824
TOTAL	HVAC			26,751	265	10,948	581	38,280
TOTAL	Bldg. 612 - Tank Maintenance			26,751	265	10,948	581	38,280

10.09. HVAC	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
10. Bldg. 658 - Temporary Motor Pool							
10.09. HVAC This system includes all equipment, distrbution systems, controls, and energy supply systems required by the heating, ventilating, and air conditioning system.							
10.09.02. Heating Generating Systems This subsystem includes steam, hot water, furnace, and heater systems. Fuel include coal, oil, gas and electric unless otherwise noted.							
10.09.02.01. Steam Boilers Assemblies include boilers, expansion tanks, chemical feeders, air separators, pumps, heat exchangers, boiler feed units, etc. This assembly would also include fittings and specialties and the flue stack. The unit of measure at the assembly level is each.							
M MIL AA <15624 1012 > 1764 MBH Oil Fired H2O Tube Blr Stl Shell w/Insul Jacket & Ctrls	2.00	EA	32,031	265	10,825	815	43,671
TOTAL Steam Boilers			32,031	265	10,825	815	43,671
TOTAL Heating Generating Systems			32,031	265	10,825	815	43,671
10.09.04. Distribution Systems This includes systems that distribute heated and cooled air, ventilating and exhaust air, hot and chilled water, steam, and glycol heating.							
10.09.04.02. Steam Distribution Systems Assemblies include pipe and fitting, including supports, wall and floor sleeves, and pipe insulation. The unit of measure at the assembly level is MBH.							
M MIL AA <15061 1608 > 3"(80mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	20.00	LF	77	3	139	1	217
M MIL AA <15185 1008 > 3"D Pipe,1" Thk Fbgs Pipe Cover w/Fire Retardant Jackets	20.00	LF	31	2	60	1	92
M MIL AA <15101 1304 > 3" Iron Body Gate Valve, Thrd 125# Bronze Mtd w/Threaded Valve	3.00	EA	476	5	206	2	684
M MIL AA <15061 1638 > 3" 90 Degree Ell,150# MI Black	6.00	EA	46	6	263	2	311
M MIL AA <15061 1698 > 3" Tee, Red Out 150# MI Black	1.00	EA	12	1	52	0	64
M MIL AA <15061 1612 > 6"(15cm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	6.00	LF	57	2	73	1	131
M MIL AA <15185 1011 > 6"D Pipe,1-1/2"Thk Fbgs Pipe Cvr w/Fire Retardant Jackets	6.00	LF	12	1	25	0	37
B MIL AA <15061 2388 > 6" Thread-O-Let, 300# Forge Stl 20% added for 6" fitting	3.00	EA	140	9	375	13	529
M MIL AA <15083 1103 > 3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends	1.00	EA	44	0	19	0	64
M MIL AA <15125 2001 > 3/4"Float&Tstat Steam Trap,15PSI	1.00	EA	64	1	28	0	92
M MIL AA <15061 1822 > 3/4" Union, 150# MI Black	4.00	EA	5	2	64	1	70
M MIL AA <15185 1002 > 3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets	10.00	LF	9	1	25	0	35

10.09. HVAC

		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	10.00	LF	6	1	27	0	33
M MIL AA <15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered	2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 >	3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst	2.00	EA	33	1	39	0	73
M MIL AA <15855 1145 >	12"x 3' Round Flue/Vent Pipe Galv Dbl Wall Breech/Smoke Pipe	10.00	EA	469	8	328	3	800
M MIL AA <15855 1186 >	12" Round Flue/Vent Pipe Tees Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	137	4	166	2	305
M MIL AA <15855 1216 >	12"Rnd Flue/Vent Adj Roof Flash Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	35	1	55	1	91
M MIL AA <15855 1196 >	12" Round Flue/Vent Top Caps Galv Dbl Wall Breech/Smoke Pipe	2.00	EA	109	1	55	1	165
M MIL AA <15063 1004 >	1"(25mm) Cu Pipe/Tubing Type L Flue Drain	20.00	LF	26	1	57	1	83
M MIL AA <15104 1103 >	1" Threaded Ball Valve, CS Trim Regular Port, Flue Drain	2.00	EA	37	1	47	0	84
M MIL AA <15063 1044 >	1" 90 Degree Elbow, Copper Flue Drain	5.00	EA	4	1	60	1	65
M MIL AA <15063 1006 >	1-1/2"(40mm) Cu Pipe/Tubing Tp L	30.00	LF	67	3	115	1	183
M MIL AA <15185 1005 >	1-1/2"D Pipe,1"Thk Fib Pipe Cvr w/Fire Retardant Jackets	30.00	LF	34	2	83	1	118
M MIL AA <15122 1105 >	1-1/2" x 1-1/2" Brz PRV, Thrd Boiler Relief Valves	2.00	EA	260	2	71	1	332
M MIL AA <15061 1635 >	1-1/2" 90 Deg Ell, 150# MI Black Boiler Relief Valve	2.00	EA	3	1	35	0	38
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot	2.00	EA	49	2	79	3	131
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Drain	15.00	LF	14	1	36	0	50
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Drain	4.00	EA	1	1	38	0	40
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Fill	30.00	LF	28	2	72	1	100
M MIL AA <15121 1202 >	3/4"Thrd St Press Regul & Red,IB Sgl Seat,Sprg Load Dir Act Diap Boiler Fill	1.00	EA	102	1	43	0	145
M MIL AA <15104 1102 >	3/4" Thrd Ball Valve, CS Trim Regular Port, Boiler Fill	3.00	EA	42	2	67	1	109
M MIL AA <15083 1103 >	3/4" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends, Boiler Fill	1.00	EA	44	0	19	0	64
M MIL AA <15080 3201 >	3.5"Diameter Dial Pressure Gauge Aluminum Case 0-300PSI Boiler Fill	1.00	EA	57	1	28	0	85
M MIL AA <15122 1102 >	3/4"x3/4"Brz Press Rlf Vlv, Thrd Boiler Fill	1.00	EA	14	1	22	0	36
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Fill	5.00	EA	2	1	48	0	50
M MIL AA <15063 1023 >	3/4" Copper Tee - Straight Sweat Boiler Fill	2.00	EA	1	1	29	0	30

10.09. HVAC			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15720 2002 >	Duplex Pump & Motor, 1 HP, 25GPM Cnds Pump w/CI Receiver,Float Sw, Condensate Return Pumps		1.00	EA	2,150	13	554	6	2,710
M MIL AA <15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings Condensate Return Pumps		40.00	LF	25	3	107	1	134
M MIL AA <15185 1002 >	3/4"D Pipe,1"Thk Fib Pipe Cover w/Fire Retardant Jackets		40.00	LF	36	3	102	1	139
M MIL AA <15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered Condensate Return Pumps		2.00	EA	18	1	39	0	58
M MIL AA <15111 1105 >	3/4" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst, Condensate Return Pumps		1.00	EA	17	0	19	0	36
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot		1.00	EA	25	1	40	1	66
M CIV AA <02113 6011 >	Rem 1/2" to 4" D Asb Pipe Insul Air-Cell Glove, Semi-Isolated		5.00	LF	20	1	22	2	44
CIV AA <02111 9202 >	Demo Metal Pipe to 4"(10cm)D Cut piping for connection to existing system (8).		5.00	LF	0	0	19	0	19
M MIL AA <15061 1636 >	2" 90 Degree ELL,150# MI Black For connection to existing system		1.00	EA	2	1	22	0	25
	TOTAL	Steam Distribution Systems			4,861	93	3,912	51	8,824
	TOTAL	Distribution Systems			4,861	93	3,912	51	8,824
	TOTAL	HVAC			36,892	357	14,737	866	52,495
	TOTAL	Bldg. 658 - Temporary Motor Pool			36,892	357	14,737	866	52,495
	TOTAL	Distributed Boilers			346,721	3,039	125,433	6,775	478,930

155 100 | Boilers

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1996 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
120	2160	794 MBH	Q-7	.45	71.111	Ea.	6,600	2,050		8,650	
	2180	1,084 MBH		.42	76.190		7,600	2,200		9,800	
	2200	1,360 MBH		.38	84.211		8,875	2,425		11,300	13,50
	2220	1,600 MBH		.31	103		10,100	2,975		13,075	15,70
	2240	2,175 MBH		.28	114		13,000	3,300		16,300	19,40
	2260	2,480 MBH		.25	128		15,200	3,700		18,900	22,40
	2280	3,000 MBH		.23	139		17,400	4,025		21,425	25,30
	2300	3,550 MBH		.22	145		19,400	4,200		23,600	27,80
	2320	3,820 MBH		.19	168		20,700	4,875		25,575	30,30
	2340	4,360 MBH		.17	188		23,100	5,450		28,550	33,70
	2360	4,940 MBH		.15	213		37,700	6,175		43,875	51,00
	2380	5,520 MBH		.13	246		43,200	7,125		50,325	58,50
	2400	6,100 MBH		.12	266		49,600	7,700		57,300	66,50
	2420	6,390 MBH		.10	320		52,500	9,250		61,750	71,50
	2440	6,680 MBH		.09	355		53,500	10,300		63,800	74,50
	2460	6,970 MBH		.08	400		55,500	11,600		67,100	78,50
	3000	Hot water, same price as steam									
	4000	For tankless coil in smaller sizes, add				Ea.	15%				
	5000	Steel, insulated jacket, burner									
	6000	Steam, full water leg construction, gross output									
	6020	144 MBH	Q-6	1.60	15	Ea.	2,825	425		3,250	3,75
	6040	198 MBH		1.40	17.143		3,075	485		3,560	4,12
	6060	252 MBH		1.30	18.462		3,825	520		4,345	5,02
	6080	324 MBH		1.20	20		4,375	565		4,940	5,67
	6100	396 MBH		.90	26.667		4,750	755		5,505	6,37
	6120	468 MBH		.80	30		5,200	850		6,050	7,02
	6140	648 MBH		.60	40		5,550	1,125		6,675	
	6160	792 MBH		.50	48		6,525	1,350		7,875	
	6180	1,008 MBH		.45	53.333		8,075	1,500		9,575	11,20
	6200	1,260 MBH		.40	60		8,950	1,700		10,650	12,40
	6220	1,512 MBH		.35	68.571		10,700	1,950		12,650	14,80
	6240	1,800 MBH		.33	72.727		11,700	2,050		13,750	16,10
	6260	2,100 MBH		.26	92.308		13,800	2,600		16,400	19,20
	6280	2,400 MBH		.22	109		15,400	3,075		18,475	21,70
	6400	Larger sizes are same as steel, gas fired									
	7000	Hot water, gross output, 103 MBH	Q-6	1.90	12.632	Ea.	1,900	355		2,255	2,65
	7020	122 MBH		1.80	13.333		1,950	375		2,325	2,72
	7040	137 MBH		1.60	15		2,050	425		2,475	2,90
	7060	168 MBH		1.50	16		2,450	450		2,900	3,40
	7080	225 MBH		1.40	17.143		2,900	485		3,385	3,92
	7100	315 MBH		1.10	21.818		4,275	615		4,890	5,65
	7120	420 MBH		.80	30		4,800	850		5,650	6,57
	7140	525 MBH		.65	36.923		6,100	1,050		7,150	8,30
	7160	630 MBH		.60	40		6,175	1,125		7,300	8,52
	7180	735 MBH		.55	43.636		8,250	1,225		9,475	11,00
	7200	840 MBH		.50	48		9,425	1,350		10,775	12,50
	7220	1,050 MBH		.42	57.143		11,400	1,625		13,025	15,10
	7240	1,365 MBH		.37	64.865		14,600	1,825		16,425	18,90
	7260	1,680 MBH		.33	72.727		17,200	2,050		19,250	22,10
	7280	2,310 MBH		.24	100		22,100	2,825		24,925	28,60
	7300	2,835 MBH		.17	141		27,500	4,000		31,500	36,30
	7320	3,150 MBH		.13	184		30,900	5,225		36,125	41,90
	7340	For tankless coil in steam or hot water, add					7%				
125	0010	BOILERS, GAS/OIL Combination with burners and controls									
	1000	Cast Iron with insulated jacket									

Fuel Oil Tank - 5000 Gallons

Fuel Oil Boiler Option
Fort Greely Utility Study
Installation of Fuel Oil
System for Boiler At School

Designed By: DGM
Estimated By:

Prepared By: TCP

Preparation Date: 03/18/96
Effective Date of Pricing: 03/18/96

Sales Tax: 0.00%

M C A C E S G O L D E D I T I O N
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Release 5.30

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

	QUANTITY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST	UNIT COST
19 Site Civil/Mechanical Utilities	1.00	EA	16,229	140	5,778	575	22,581	22581.00
TOTAL Fuel Oil Boiler Option	1.00	EA	16,229	140	5,778	575	22,581	22581.00
Contractor's Overhead							3,387	
SUBTOTAL							25,968	
Contractor's Profit							2,597	
SUBTOTAL							28,565	
Contractor's Bond							857	
TOTAL INCL INDIRECTS							29,422	
Escalation							1,177	
SUBTOTAL							30,599	
Contingency							6,120	
TOTAL INCL OWNER COSTS							36,719	

F2-3

19.08. Building Fuel Distribution Syst				QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
19. Site Civil/Mechanical Utilities										
19.08. Building Fuel Distribution System										
19.08.01. Fuel Distribution Piping										
	M MIL AA	<15142 1103 >	10GPM CI Rotary Pump, 60PSI 1HP w/1" Discharge	1.00	EA	1,064	13	521	5	1,590
	M MIL AA	<15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	150.00	LF	95	10	403	4	501
	M MIL AA	<15061 1632 >	3/4" 90 Deg Ell, 150# MI Black	8.00	EA	3	2	99	1	103
	M MIL AA	<15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered	4.00	EA	37	2	78	1	115
	M MIL AA	<15061 1822 >	3/4" Union, 150# MI Black	8.00	EA	10	3	128	1	139
	M CIV AA	<16111 1402 >	3/4"Liquid-Tight Flex Assem, 3' Conduit w/Straight Connectors	2.00	EA	20	2	80	0	100
	M MIL AA	<16111 3204 >	RGS PVC Ctd 3/4"Conduit w/Cplg Direct Burial,20 Mil Coated For electrical connection to pump.	150.00	LF	321	8	324	0	645
	B MIL AA	<16120 1222 >	#10 AWG Cable-XLP (xhhw) 600V Cu,Sgl Strd,Pl in Cnd,12'Hg.	0.50	MLF	65	5	194	1	259
	M USR AA	< >	Level Switch, Hvy Dty, UL Listed Weatherproof, 10 Amp Rated	1.00	EA	500	3	110	0	610
	M MIL AA	<16155 3112 >	Comb Str,Sz 1,NEMA 1 w/Disc Sw Non-Reversing,240-600V,3P	1.00	EA	310	7	318	1	628
	M MIL AA	<16155 2132 >	H-O-A Sel Sw,Factory Mod-NEMA 1 Mag Mtr Starter,N-Rev,208-600V	1.00	EA	44	0	0	0	44
	M MIL AA	<16155 2133 >	Pilot Light,Factory Mod-NEMA 1 Mag Mtr Starter,N-Rev,208-600V	1.00	EA	53	0	0	0	53
	M MIL AA	<16155 2151 >	Mag Str xfmr,Size 0,1,Fcty Mod Standard Control Transformer	1.00	EA	61	0	0	0	61
	M MIL AA	<16155 1241 >	Auxiliary Contact,Normally Open	3.00	EA	17	0	0	0	17
	M MIL AA	<16155 1242 >	Auxiliary Cont,Normally Closed	1.00	EA	6	0	0	0	6
		TOTAL	Fuel Distribution Piping			2,605	54	2,254	14	4,872
19.08.02. Fuel Storage Tanks										
	CIV AA	<02225 1453 >	Bulk Site Excavation, Heavy Clay 4 CY Bucket Drag Line	200.00	CY	0	3	129	193	321
	M MIL AA	<03311 1166 >	Pour Slab on Gr,>= 6", Conc Pump >= (15 cm) Place 3000 PSI Conc	6.00	CY	552	1	44	13	609
	M MIL AA	<15176 4002 >	5000Gal Ugnd Dbl Wall Stl Tank Coated,In Place w/Hold Down Bars. Material price taken from 1996 Means Mechanical, escalated for Alaska costs.	1.00	EA	7,870	43	1,759	132	9,762
	MIL AA	<02222 4104 >	Foundation Backfill, w/Loader 6" Lift without Compaction	150.00	CY	0	3	129	78	206

19.08. Building Fuel Distribution Syst			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
USR AA <	>	Containment Basin/Tank Sump	1.00	EA	410	2	100	60	570
M MIL AA <15176 1005	>	50 Gal Day Tank Abv Gnd w/Supp,Coating&Fittings	1.00	EA	1,292	25	1,005	76	2,373
M MIL AA <15176 6011	>	Sgl Chnl Ugnd Tk Monitoring Sys Material price taken from 1996 Means Mechanical,.	1.00	EA	3,500	8	359	9	3,868
	TOTAL	Fuel Storage Tanks			13,624	86	3,524	561	17,709
	TOTAL	Building Fuel Distribution Syst			16,229	140	5,778	575	22,581
	TOTAL	Site Civil/Mechanical Utilities			16,229	140	5,778	575	22,581
	TOTAL	Fuel Oil Boiler Option			16,229	140	5,778	575	22,581

Fuel Oil Tank - 2000 Gallons

Fuel Oil Boiler Option-5 Bldgs.
Fort Greely Utility Study
Installation of Fuel Oil
System for Boilers (Typical of
Bldg. 503,605,615,820,821)

Designed By: DGM
Estimated By:

Prepared By: TCP

Preparation Date: 03/18/96
Effective Date of Pricing: 03/18/96

Sales Tax: 0.00%

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U.S. Army Corps of Engineers
PROJECT GRLYM9: Fuel Oil Boiler Option-5 Bldgs. - Fort Greely Utility Study
Ft. Greely Utility Study (Fuel Oil System)
** PROJECT DIRECT SUMMARY - Scope **

	QUANTITY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST	UNIT COST
19 Site Civil/Mechanical Utilities	1.00	EA	10,614	99	4,117	254	14,985	14984.86
TOTAL Fuel Oil Boiler Option-5 Bldgs.	1.00	EA	10,614	99	4,117	254	14,985	14984.86
Contractor's Overhead							2,248	
SUBTOTAL							17,233	
Contractor's Profit							1,723	
SUBTOTAL							18,956	
Contractor's Bond							569	
TOTAL INCL INDIRECTS							19,525	
Escalation							781	
SUBTOTAL							20,306	
Contingency							4,061	
TOTAL INCL OWNER COSTS							24,367	

0.01. Prime Contractor				QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
0.01. Prime Contractor Cost estimate is calculated as typical for each building. Applies to Buildings 503, 605, 615, 820, and 821.										
19. Site Civil/Mechanical Utilities										
19.08. Building Fuel Distribution System										
19.08.01. Fuel Distribution Piping										
	M	MIL AA	<15142 1102 >	10GPM CI Rotary Pump,40PSI 3/4HP w/1" Discharge	1.00	EA	1,005	11	438	4	1,447
	M	MIL AA	<15061 1602 >	3/4"(20mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	125.00	LF	79	8	336	3	417
	M	MIL AA	<15061 1632 >	3/4" 90 Deg Ell, 150# MI Black	8.00	EA	3	2	99	1	103
	M	MIL AA	<15101 1104 >	3/4" Bronze 125# Gate Valve Threaded,Brazed or Soldered	4.00	EA	37	2	78	1	115
	M	MIL AA	<15061 1822 >	3/4" Union, 150# MI Black	8.00	EA	10	3	128	1	139
	M	CIV AA	<16111 1402 >	3/4"Liquid-Tight Flex Assem, 3' Conduit w/Straight Connectors	2.00	EA	20	2	80	0	100
	M	MIL AA	<16111 3204 >	RGS PVC Ctd 3/4"Conduit w/Cplg Direct Burial,20 Mil Coated For electrical connection to pump.	125.00	LF	268	7	270	0	538
	B	MIL AA	<16120 1222 >	#10 AWG Cable-XLP (xhhw) 600V Cu,Sgl Strd,Pl in Cnd,12'Hg.	0.50	MLF	65	5	194	1	259
	M	USR AA	< >	Level Switch, Hvy Dty, UL Listed Weatherproof, 10 Amp Rated	1.00	EA	500	3	110	0	610
	M	MIL AA	<16155 3112 >	Comb Str,Sz 1,NEMA 1 w/Disc Sw Non-Reversing,240-600V,3P	1.00	EA	310	7	318	1	628
	M	MIL AA	<16155 2132 >	H-O-A Sel Sw,Factory Mod-NEMA 1 Mag Mtr Starter,N-Rev,208-600V	1.00	EA	44	0	0	0	44
	M	MIL AA	<16155 2133 >	Pilot Light,Factory Mod-NEMA 1 Mag Mtr Starter,N-Rev,208-600V	1.00	EA	53	0	0	0	53
	M	MIL AA	<16155 2151 >	Mag Str xfmr,Size 0,1,Fcty Mod Standard Control Transformer	1.00	EA	61	0	0	0	61
	M	MIL AA	<16155 1241 >	Auxiliary Contact,Normally Open	3.00	EA	17	0	0	0	17
	M	MIL AA	<16155 1242 >	Auxiliary Cont,Normally Closed	1.00	EA	6	0	0	0	6
			TOTAL	Fuel Distribution Piping			2,477	49	2,049	13	4,538
19.08.02. Fuel Storage Tanks											
		CIV AA	<02225 1453 >	Bulk Site Excavation, Heavy Clay 4 CY Bucket Drag Line	39.00	CY	0	1	25	38	63
	M	MIL AA	<03311 1166 >	Pour Slab on Gr,>= 6", Conc Pump >= (15 cm) Place 3000 PSI Conc	2.00	CY	184	0	15	4	203

19.08. Building Fuel Distribution Syst			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15176 4007 >	2000Gal Ugnd Dbl Wall Stl Tank Coated,In Place w/Hold Down Bars. Material price taken from Means Mechanical, escalated for Alaska costs.		1.00	EA	4,268	13	541	41	4,850
MIL AA <02222 4104 >	Foundation Backfill, w/Loader 6" Lift without Compaction		27.00	CY	0	1	23	14	37
USR AA < >	Containment Basin/Tank Sump		1.00	EA	410	2	100	60	570
M MIL AA <15176 1005 >	50 Gal Day Tank Abv Gnd w/Supp,Coating&Fittings		1.00	EA	1,292	25	1,005	76	2,373
M MIL AA <15176 6011 >	Sgl Chnl Ugnd Tk Monitoring Sys		1.00	EA	1,983	8	359	9	2,351
	TOTAL	Fuel Storage Tanks			8,137	50	2,068	241	10,446
	TOTAL	Building Fuel Distribution Syst			10,614	99	4,117	254	14,985
	TOTAL	Site Civil/Mechanical Utilities			10,614	99	4,117	254	14,985
	TOTAL	Fuel Oil Boiler Option-5 Bldgs.			10,614	99	4,117	254	14,985

Fuel Oil Tank - 1000 Gallons

Fuel Oil Boiler Option-Bldg. 504
Fort Greely Utility Study
Installation of Fuel Oil
Boilers - Building 504

Designed By: DGM
Estimated By:

Prepared By: TCP

Preparation Date: 03/18/96
Effective Date of Pricing: 03/18/96

Sales Tax: 0.00%

No Backup Reports...

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	QUANTITY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST	UNIT COST
19 Site Civil/Mechanical Utilities	1.00	EA	9,529	84	3,510	227	13,266	13265.57
TOTAL Fuel Oil Boiler Option-Bldg. 504	1.00	EA	9,529	84	3,510	227	13,266	13265.57
Contractor's Overhead							1,990	
SUBTOTAL							15,255	
Contractor's Profit							1,526	
SUBTOTAL							16,781	
Contractor's Bond							503	
TOTAL INCL INDIRECTS							17,284	
Escalation							691	
SUBTOTAL							17,976	
Contingency							3,595	
TOTAL INCL OWNER COSTS							21,571	

19.08. Building Fuel Distribution Syst

			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
19. Site Civil/Mechanical Utilities									
19.08. Building Fuel Distribution System									
19.08.01. Fuel Distribution Piping									
M MIL AA <15142 1101 >	10GPM CI Rotary Pump,20PSI 1/2HP w/1" Discharge		1.00	EA	1,005	9	362	4	1,370
M MIL AA <15101 1103 >	1/2" Bronze 125# Gate Valve Threaded,Brazed or Soldered		2.00	EA	15	1	29	0	44
M MIL AA <15061 1821 >	1/2" Union, 150# MI Black		4.00	EA	5	1	55	1	61
M MIL AA <15061 1601 >	1/2"(12mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings		100.00	LF	54	6	252	2	309
M MIL AA <15083 1102 >	1/2" Strainer (Iron Body) Y-Type, 250#(113kg) Screwed Ends		1.00	EA	39	0	14	0	54
M MIL AA <15111 1104 >	1/2" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst		1.00	EA	14	0	14	0	28
M CIV AA <16111 1401 >	1/2"Liquid-Tight Flex Assem, 3' Conduit w/Straight Connectors		2.00	EA	15	2	73	0	88
M MIL AA <16111 3204 >	RGS PVC Ctd 3/4"Conduit w/Cplg Direct Burial,20 Mil Coated		100.00	LF	214	5	216	0	430
B MIL AA <16120 1222 >	#10 AWG Cable-XLP (xhhw) 600V Cu,Sgl Strd,Pl in Cnd,12'Hg		0.50	MLF	65	5	194	1	259
B USR AA < >	Level Switch, Hvy Dty, UL Listed 600V Cu,Sgl Strd,Pl in Cnd,12'Hg		1.00	EA	500	3	110	0	610
M MIL AA <16155 3112 >	Comb Str,Sz 1,NEMA 1 w/Disc Sw Non-Reversing,240-600V,3P		1.00	EA	310	7	318	1	628
M MIL AA <16155 2132 >	H-O-A Sel Sw,Factory Mod-NEMA 1 Mag Mtr Starter,N-Rev,208-600V		1.00	EA	44	0	0	0	44
M MIL AA <16155 2133 >	Pilot Light,Factory Mod-NEMA 1 Mag Mtr Starter,N-Rev,208-600V		1.00	EA	53	0	0	0	53
M MIL AA <16155 2151 >	Mag Str xfmr,Size 0,1,Fcty Mod Standard Control Transformer		1.00	EA	61	0	0	0	61
M MIL AA <16155 1241 >	Auxiliary Contact,Normally Open		3.00	EA	17	0	0	0	17
M MIL AA <16155 1242 >	Auxiliary Cont,Normally Closed		1.00	EA	6	0	0	0	6
	TOTAL Fuel Distribution Piping				2,416	39	1,638	9	4,063
19.08.02. Fuel Storage Tanks									
CIV AA <02225 1453 >	Bulk Site Excavation, Heavy Clay 4 CY Bucket Drag Line		30.00	CY	0	1	19	29	48
M MIL AA <03311 1166 >	Pour Slab on Gr,>= 6", Conc Pump >= (15 cm) Place 3000 PSI Conc		2.00	CY	184	0	15	4	203
M MIL AA <15176 4006 >	1000Gal Ugnd Dbl Wall Stl Tank Coated,In Place w/Hold Down Bars		1.00	EA	3,244	9	352	26	3,622
MIL AA <02222 4104 >	Foundation Backfill, w/Loader 6" Lift without Compaction		25.00	CY	0	1	21	13	34
USR AA < >	Containment Basin/Tank Sump 6" Lift without Compaction		1.00	EA	410	3	100	60	570
M MIL AA <15176 1005 >	50 Gal Day Tank Abv Gnd w/Supp,Coating&Fittings		1.00	EA	1,292	25	1,005	76	2,373

19.08. Building Fuel Distribution Syst	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
M MIL AA <15176 6011 > Sgl Chnl Ugnd Tk Monitoring Sys	1.00	EA	1,983	8	359	9	2,351
TOTAL Fuel Storage Tanks			7,113	45	1,872	218	9,202
TOTAL Building Fuel Distribution Syst			9,529	84	3,510	227	13,266
TOTAL Site Civil/Mechanical Utilities			9,529	84	3,510	227	13,266
TOTAL Fuel Oil Boiler Option-Bldg. 504			9,529	84	3,510	227	13,266

Water Wells to Cisterns

Domestic Water Option
Fort Greely Utility Study
Installation of Domestic Water
Well and Fire Protection System

Designed By: DGM
Estimated By:

Prepared By: TCP

Preparation Date: 03/18/96
Effective Date of Pricing: 03/18/96

Sales Tax: 0.00%

F5-1

No Backup Reports...

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	QUANTITY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST	UNIT COST
19 Site Civil/Mechanical Utilities	1.00	EA	541,150	2,016	81,348	16,991	639,489	639488.55
TOTAL Domestic Water Option	1.00	EA	541,150	2,016	81,348	16,991	639,489	639488.55
Contractor's Overhead							95,923	
SUBTOTAL							735,412	
Contractor's Profit							73,541	
SUBTOTAL							808,953	
Contractor's Bond							24,269	
TOTAL INCL INDIRECTS							833,222	
Escalation							33,329	
SUBTOTAL							866,550	
Contingency							173,310	
TOTAL INCL OWNER COSTS							1,039,861	

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19.01. Water Supply & Distribution			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
19. Site Civil/Mechanical Utilities									
19.01. Water Supply & Distribution Systems									
19.01.01. Well Systems									
	M MIL AA <02580 1001 >	4"(10cm) to 6"(15cm) Water Well Drilled and Cased, Incl Casing	2000.00	VLF	25,600	485	17,929	11,838	55,367
	M MIL AA <15146 3001 >	15-135 GPH Submersible Pump 6" Disch for Wells, 200-500'Deep To 500 Ft (152M) Deep, 15 To 135 Gpm	10.00	EA	16,080	280	11,769	1,576	29,425
	TOTAL	Well Systems			41,680	765	29,699	13,414	84,792
19.01.02. Potable Water Distribution									
	M MIL AA <15061 1606 >	2"(50mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	4200.00	LF	7,728	442	18,397	172	26,297
	M MIL AA <15101 1108 >	2" Bronze 125# Gate Valve Threaded,Brazed or Soldered	7.00	EA	191	6	284	3	478
	M MIL AA <15061 1826 >	2" Union, 150# MI Black	14.00	EA	55	11	466	4	525
	M MIL AA <15111 1109 >	2" Swing Check Valve Brz 125# for Thrd,Brazed or Soldered Inst	7.00	EA	216	6	284	3	503
	TOTAL	Potable Water Distribution			8,189	466	19,432	181	27,802
19.01.03. Potable Water Storage									
	M MIL AA <15176 1004 >	100Gal Stl Stor Tk,w/3/16"Shell Abv Gnd w/Supp,Coating&Fittings	2.00	EA	2,251	40	1,636	18	3,905
	M MIL AA <15176 1005 >	200Gal Stl Stor Tk,w/3/16"Shell Abv Gnd w/Supp,Coating&Fittings	5.00	EA	6,459	123	5,026	378	11,863
	M MIL AA <15176 2004 >	800Gal Stl Stor Tk,w/5/6"Shell Ugnd,Incl Setting&Hold Down Bars	1.00	EA	5,789	43	1,759	132	7,680
	M MIL AA <15176 2005 >	1500Gal Stl Stor Tk,w/5/6"Shell Ugnd,Incl Setting&Hold Down Bars	2.00	EA	20,368	138	5,629	424	26,421
	TOTAL	Potable Water Storage			34,867	343	14,050	953	49,870
19.01.04. Fire Protection Water Distrib.									
	MIL AA <02221 1103 >	Trenching,1 CY Gradall, Hvy Soil 75 CY/ Hr (58M3)/Hr,Cont Fig Exc	3000.00	CY	0	79	3,196	1,979	5,175
	MIL AA <02221 5003 >	Backfill Trench w/Sm FEnd Loader Without Compaction	612.00	CY	0	13	525	317	842
	M MIL AA <15062 1003 >	4"(10cm)Cast Iron Pipe & Fitting	1100.00	LF	4,686	200	8,322	78	13,086
	TOTAL	Fire Protection Water Distrib.			4,686	292	12,043	2,374	19,103

19.01. Water Supply & Distribution		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
19.01.05. Fire Protection Water Storage								
	M MIL AA <15177 1016 > 50000Gal Horiz Cylind Plastic Tk With 6" NPT Connection	11.00	EA	451,728	150	6,125	69	457,922
	TOTAL Fire Protection Water Storage			451,728	150	6,125	69	457,922
	TOTAL Water Supply & Distribution			541,150	2,016	81,348	16,991	639,489
	TOTAL Site Civil/Mechanical Utilities			541,150	2,016	81,348	16,991	639,489
	TOTAL Domestic Water Option			541,150	2,016	81,348	16,991	639,489

Septic Field

Septic Field Option
Fort Greely Utility Study
Installation of Septic Field

Designed By: DGM
Estimated By:

Prepared By: TCP

Preparation Date: 03/18/96
Effective Date of Pricing: 03/18/96

Sales Tax: 0.00%

No Backup Reports...

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	QUANTITY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST	UNIT COST
19 Site Civil/Mechanical Utilities	1.00	EA	73,993	8,038	234,567	101,800	410,359	410358.93
TOTAL Septic Field Option	1.00	EA	73,993	8,038	234,567	101,800	410,359	410358.93
Contractor's Overhead							61,554	
SUBTOTAL							471,913	
Contractor's Profit							47,191	
SUBTOTAL							519,104	
Contractor's Bond							15,573	
TOTAL INCL INDIRECTS							534,677	
Escalation							21,387	
SUBTOTAL							556,064	
Contingency							111,213	
TOTAL INCL OWNER COSTS							667,277	

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19.02. Sanitary Sewer Systems			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
19. Site Civil/Mechanical Utilities									
19.02. Sanitary Sewer Systems									
19.02.01. Sanitary Sewer Piping									
M MIL AA	<15062 1003 >	4"(10cm)Cast Iron Pipe & Fitting	1100.00	LF	4,686	200	8,322	78	13,086
M MIL AA	<15062 1223 >	4" (1/4 Bend) Cast Iron Fitting	110.00	EA	2,181	71	2,943	27	5,152
M MIL AA	<15062 1233 >	4" (1/8 Bend) Cast Iron Fitting	110.00	EA	1,746	79	3,293	31	5,070
MIL AA	<02221 1103 >	Trenching,1 CY Gradall, Hvy Soil 75 CY/ Hr (58M3)/Hr,Cont Fig Exc	2300.00	CY	0	61	2,450	1,517	3,968
MIL AA	<02221 5003 >	Backfill Trench w/Sm FEnd Loader Without Compaction	2300.00	CY	0	49	1,972	1,192	3,164
		TOTAL Sanitary Sewer Piping			8,613	460	18,981	2,845	30,439
19.02.05. Septic Tanks									
M MIL AA	<02560 6001 >	1,000 Gal Precast Septic Tank No Excavation or Piping	2.00	EA	1,420	7	294	39	1,753
M MIL AA	<02560 6002 >	2,000 Gal Precast Septic Tank No Excavation or Piping	2.00	EA	1,812	11	471	63	2,346
M MIL AA	<02560 6002 >	3,000 Gal Precast Septic Tank No Excavation or Piping	2.00	EA	1,812	11	471	63	2,346
M MIL AA	<02560 6003 >	4,000 Gal Precast Septic Tank No Excavation or Piping	3.00	EA	10,115	49	2,072	277	12,465
M MIL AA	<02560 6003 >	5,000 Gal Precast Septic Tank No Excavation or Piping	2.00	EA	6,744	33	1,381	185	8,310
		TOTAL Septic Tanks			21,902	112	4,689	628	27,219
19.02.06. Drain Fields									
MIL AA	<02221 1103 >	Trenching,1 CY Gradall, Hvy Soil 75 CY/ Hr (58M3)/Hr,Cont Fig Exc	44489	CY	0	1,175	47,399	29,345	76,744
MIL AA	<02221 6002 >	Sprd Dumped Fill/Grvl 12" Layers Without Compaction	39000	SF	0	51	2,009	3,089	5,097
M USR AA	<02221 8001 >	Sand Bedding w/Sm FEnd Loader	2167.00	CY	29,298	2,384	12,569	4,551	46,417
MIL AA	<02221 5003 >	Backfill Trench w/Sm FEnd Loader Without Compaction	40874	CY	0	875	35,041	21,181	56,222
M MIL AA	<02512 2001 >	Plastic Filter Fabric Underground Drain Lines	390.00	CSF	4,033	485	17,930	5,438	27,401
M MIL AA	<02560 6021 >	5 Outlet Conc Distribution Box	11.00	EA	787	14	573	5	1,365
M MIL AA	<02511 2101 >	4"Dia Perf PVC Pipe, Underdrain (10cm) Diameter	19500	LF	9,360	2,484	95,376	34,718	139,454
		TOTAL Drain Fields			43,477	7,467	210,896	98,327	352,701

19.02. Sanitary Sewer Systems	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
19.02.9X. Other Sanitary Sewer							
TOTAL Other Sanitary Sewer			0	0	0	0	0
TOTAL Sanitary Sewer Systems			73,993	8,038	234,567	101,800	410,359
TOTAL Site Civil/Mechanical Utilities			73,993	8,038	234,567	101,800	410,359
TOTAL Septic Field Option			73,993	8,038	234,567	101,800	410,359

Water Pipe Insulation

Pipe Insulation Option
Fort Greely Utility Study
Installation of Pipe Insulation
Domestic Water
Distribution System

Designed By: DEJ
Estimated By:

Prepared By: TCP

Preparation Date: 03/18/96
Effective Date of Pricing: 03/18/96

Sales Tax: 0.00%

F7-1

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		QUANTITY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST	UNIT COST
19	Site Civil/Mechanical Utilities	1.00	EA	39,841	1,208	47,789	476	88,106	88105.95
TOTAL	Pipe Insulation Option	1.00	EA	39,841	1,208	47,789	476	88,106	88105.95
	Contractor's Overhead							13,216	
	SUBTOTAL							101,322	
	Contractor's Profit							10,132	
	SUBTOTAL							111,454	
	Contractor's Bond							3,344	
	TOTAL INCL INDIRECTS							114,798	
	Escalation							4,592	
	SUBTOTAL							119,390	
	Contingency							23,878	
	TOTAL INCL OWNER COSTS							143,267	

19.01. Water Supply & Distribution	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
19. Site Civil/Mechanical Utilities							
19.01. Water Supply & Distribution Systems							
19.01.02. Potable Water Distribution							
M MIL AA <15182 1012 > Fbgs Cover for 8" D Pipe, 2" Thk With Fire Retardant Jacket	10.00	LF	75	1	53	1	128
M MIL AA <15182 1011 > Fbgs Cover for 6"D Pipe,1-1/2"Tk With Fire Retardant Jacket	1300.00	LF	4,290	137	5,426	54	9,770
M MIL AA <15182 1011 > Fbgs Cover for 6"D Pipe,1-1/2"Tk With Fire Retardant Jacket	100.00	LF	330	11	417	4	751
M MIL AA <15182 1011 > Fbgs Cover for 6"D Pipe,1-1/2"Tk With Fire Retardant Jacket	110.00	LF	363	12	459	5	827
M MIL AA <15182 1012 > Fbgs Cover for 8" D Pipe, 2" Thk With Fire Retardant Jacket	220.00	LF	1,648	29	1,163	12	2,822
M MIL AA <15182 1012 > Fbgs Cover for 8" D Pipe, 2" Thk With Fire Retardant Jacket	280.00	LF	2,097	37	1,480	15	3,592
M MIL AA <15182 1012 > Fbgs Cover for 8" D Pipe, 2" Thk With Fire Retardant Jacket	540.00	LF	4,045	72	2,855	28	6,928
M MIL AA <15182 1004 > Fbgs Cover for 1-1/4"D Pipe,1"Tk With Fire Retardant Jacket	190.00	LF	201	12	486	5	692
M MIL AA <15182 1011 > Fbgs Cover for 6"D Pipe,1-1/2"Tk With Fire Retardant Jacket	120.00	LF	396	13	501	5	902
M MIL AA <15182 1004 > Fbgs Cover for 1-1/4"D Pipe,1"Tk With Fire Retardant Jacket	130.00	LF	138	8	333	3	474
M MIL AA <15182 1011 > Fbgs Cover for 6"D Pipe,1-1/2"Tk With Fire Retardant Jacket	40.00	LF	132	4	167	2	301
M MIL AA <15182 1009 > Fbgs Cover for 4" D Pipe, 1" Thk With Fire Retardant Jacket	130.00	LF	259	10	412	4	675
M MIL AA <15182 1011 > Fbgs Cover for 6"D Pipe,1-1/2"Tk With Fire Retardant Jacket	350.00	LF	1,155	37	1,461	15	2,630
M MIL AA <15182 1007 > Fbgs Cover for 2-1/2"D Pipe,1"Tk With Fire Retardant Jacket	120.00	LF	166	9	352	4	522
M MIL AA <15182 1011 > Fbgs Cover for 6"D Pipe,1-1/2"Tk With Fire Retardant Jacket	640.00	LF	2,112	67	2,671	27	4,810
M MIL AA <15182 1011 > Fbgs Cover for 6"D Pipe,1-1/2"Tk With Fire Retardant Jacket	190.00	LF	627	20	793	8	1,428
M MIL AA <15182 1006 > Fbgs Cover for 2" D Pipe, 1" Thk With Fire Retardant Jacket	60.00	LF	74	4	170	2	246
M MIL AA <15182 1011 > Fbgs Cover for 6"D Pipe,1-1/2"Tk With Fire Retardant Jacket	100.00	LF	330	11	417	4	751
M MIL AA <15182 1006 > Fbgs Cover for 2" D Pipe, 1" Thk With Fire Retardant Jacket	30.00	LF	37	2	85	1	123
M MIL AA <15182 1011 > Fbgs Cover for 6"D Pipe,1-1/2"Tk With Fire Retardant Jacket	360.00	LF	1,188	38	1,502	15	2,705
M MIL AA <15182 1011 > Fbgs Cover for 6"D Pipe,1-1/2"Tk With Fire Retardant Jacket	320.00	LF	1,056	34	1,336	13	2,405
M MIL AA <15182 1008 > Fbgs Cover for 3" D Pipe, 1" Thk With Fire Retardant Jacket	190.00	LF	293	15	579	6	878
M MIL AA <15182 1011 > Fbgs Cover for 6"D Pipe,1-1/2"Tk With Fire Retardant Jacket	240.00	LF	792	25	1,002	10	1,804

			QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
19.01. Water Supply & Distribution									
	M MIL AA <15182 1007 >	Fbgs Cover for 2-1/2"D Pipe,1"Tk With Fire Retardant Jacket	210.00	LF	290	16	617	6	913
	TOTAL	Potable Water Distribution			22,093	624	24,737	246	47,076
	TOTAL	Water Supply & Distribution			22,093	624	24,737	246	47,076
19.02. Site Preparation									
	M CIV AA <02113 4055 >	PCM Air Sample Analysis for Asb Assume 20 air samples for pre-abatement, 20 for abatement, and 20 for post-abatement.	60.00	EA	2,862	0	0	0	2,862
	M CIV AA <02113 4061 >	Personnel Equipment, Worker/Day Coveralls, Respirator, Gloves	120.00	EA	4,446	0	0	0	4,446
	B CIV AA <02113 4044 >	Wrap-Up Area w/1 layer of poly 2 Layers of 6mm Sheeting. Assume 6000 LF x 10 LF width. Cost taken from Means Mechanical.	60000	SF	4,200	306	12,012	120	16,332
	USR AA < >	Spray pipes w/surfactant-lockdwn Cost taken from Means Mechanical. Assume 1 steam and 1 condensate pipe (6000 LF each).	12000	LF	6,240	278	11,040	110	17,390
	TOTAL	Site Preparation			17,748	584	23,052	230	41,030
	TOTAL	Site Civil/Mechanical Utilities			39,841	1,208	47,789	476	88,106
	TOTAL	Pipe Insulation Option			39,841	1,208	47,789	476	88,106

020 800 | Haz. Mat'l Abatement

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1996 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P	
810	1800	Vacuum loader, 9-18 ton/hr (R020-820)				Ea.	80,000			80,000	88,000	810
	1900	Water atomizer unit, including 55 gal. drum					200			200	220	
	2000	Worker protection, whole body, foot and head cover, gloves					10			10	11	
	2500	Respirator, single use					10			10	11	
	2550	Cartridge for respirator					3			3	3.30	
	2570	Glove bag, 7 mil, 50" x 64"					6			6	6.60	
	2580	10 mil, 44" x 60"					6.25			6.25	6.90	
	3000	HEPA vacuum for work area, minimun					1,000			1,000	1,100	
	3050	Maximum					4,000			4,000	4,400	
	6000	Disposable polyethelene bags, 6 mil, 3 C.F.					.60			.60	.66	
	6300	Disposable fiber drums, 3 C.F.					5.75			5.75	6.35	
	6400	Pressure sensitive caution lables, 3" x 5"					.13			.13	.15	
	6450	11" x 17"					.16			.16	.18	
820	0010	ASBESTOS ABATEMENT WORK AREA Containment and preparation.										820
	0100	Pre-cleaning, HEPA vacuum and wet wipe	A-10	14,400	.004	S.F.		.13		.13	.22	
	0200	Protect carpeted area, 2 layers 6 mil poly on 3/4" plywood	"	1,000	.064		1.25	1.83	.07	3.15	4.43	
	0300	Separation barrier, 2" x 4" @ 16", 1/2" plywood ea. side, 8' high	F-2	400	.040		1	1.01	.05	2.06	2.76	
	0310	12' high (R020-820)		320	.050		1.10	1.26	.06	2.42	3.28	
	0320	16' high		200	.080		1.25	2.02	.09	3.36	4.70	
	0400	Personnel decontam. chamber, 2" x 4" @ 16", 3/4" ply ea. side		280	.057		2.05	1.44	.07	3.56	4.63	
	0450	Waste decontam. chamber, 2" x 4" studs @ 16", 3/4" ply ea side		360	.044		2.60	1.12	.05	3.77	4.71	
	0500	Cover surfaces with polyethelene sheeting,										
	0501	Including glue and tape										
	0550	Floors, each layer, 6 mil	A-10	8,000	.008	S.F.	.07	.23	.01	.31	.46	
	0551	4 mil		9,000	.007		.05	.20	.01	.26	.40	
	0560	Walls, each layer, 6 mil		6,000	.011		.07	.31	.01	.39	.59	
	0561	4 mil		7,000	.009		.05	.26	.01	.32	.50	
	0570	For heights above 12', add				%		20%				
	0575	For heights above 20', add				"		30%				
	0580	For fire retardant poly, add				S.F.	100%					
	0590	For large open areas, deduct				%	10%	20%				
	0600	Seal wall penetrations with foam firestop to 36 Sq. In.	F-2	200	.080	Ea.	2.45	2.02	.09	4.56	6	
	0610	36 Sq. In. to 72 Sq. In.		125	.128		5.95	3.23	.15	9.33	11.85	
	0615	72 Sq. In. to 144 Sq. In.		80	.200		12	5.05	.23	17.28	21.50	
	0620	Seal wall penetrations with foam firestop to 36 Sq. In.		180	.089		2.45	2.24	.10	4.79	6.40	
	0630	36 Sq. In. to 72 Sq. In.		100	.160		5.95	4.03	.18	10.16	13.20	
	0640	72 Sq. In. to 144 Sq. In.		60	.267		12	6.70	.31	19.01	24.50	
	0800	Caulk seams with latex	1 Carp	230	.035	L.F.	.15	.88		1.03	1.57	
830	0010	DEMOLITION IN ASBESTOS CONTAMINATED AREA										830
	0200	Ceiling, including suspension system, plaster and lath	A-9	2,100	.030	S.F.		.87	.10	.97	1.53	
	0210	Finished plaster, leaving wire lath		585	.109			3.13	.38	3.51	5.50	
	0220	Suspended acoustical tile		3,500	.018			.52	.06	.58	.92	
	0230	Splined tile grid system		3,000	.021			.61	.07	.68	1.07	
	0240	Metal pan grid system		1,500	.043			1.22	.15	1.37	2.14	
	0250	Gypsum board		2,500	.026			.73	.09	.82	1.29	
	0260	Lighting fixtures up to 2' x 4'		72	.889	Ea.		25.50	3.05	28.55	45	
	0400	Partitions, non load bearing										
	0410	Plaster, lath, and studs	A-9	690	.093	S.F.		2.65	.32	2.97	4.66	
	0450	Gypsum board and studs	"	1,390	.046	"		1.32	.16	1.48	2.31	
	9000	For type C (supplied air) respirator equipment, add				%					10%	
840	0010	BULK ASBESTOS REMOVAL										840
	0020	Includes disposable tools and 4 suits and respirators/day/worker										
	0200	Boiler insulation	A-9	480	.133	S.F.		3.81	.46	4.27	6.70	
	0210	With metal lath add				%				50%		

020 800 | Haz. Mat'l Abatement

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1996 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
840	0300	Boiler breeching or flue insulation	A-9	520	.123	S.F.		3.52	.42	3.94	6.1
	0310	For active boiler, add				%				100%	
	0400	Duct or AHU insulation	A-9	720	.089	S.F.		2.54	.30	2.84	4.4
	0500	Duct vibration isolation joints, up to 24 Sq. In. duct		56	1.143	Ea.		32.50	3.92	36.42	57.5
	0520	25 Sq. In. to 48 Sq. In. duct		48	1.333			38	4.57	42.57	67
	0530	49 Sq. In. to 76 Sq. In. duct		40	1.600			46	5.50	51.50	80.5
	0600	Pipe insulation up to 4" diameter pipe		900	.071	L.F.		2.03	.24	2.27	3.5
	0610	4" to 8" diameter pipe		800	.080			2.29	.27	2.56	4.0
	0620	10" to 12" diameter pipe		700	.091			2.62	.31	2.93	4.5
	0630	14" to 16" diameter pipe		550	.116			3.33	.40	3.73	5.8
	0650	Over 16" diameter pipe		650	.098	S.F.		2.82	.34	3.16	4.9
	0700	With glove bag up to 3" diameter pipe		100	.640	L.F.	5.75	18.30	2.20	26.25	39
	1000	Pipe fitting insulation up to 4" diameter pipe		320	.200	Ea.		5.70	.69	6.39	10.0
	1100	6" to 8" diameter pipe		304	.211			6	.72	6.72	10.6
	1110	10" to 12" diameter pipe		192	.333			9.55	1.14	10.69	16.7
	1120	14" to 16" diameter pipe		128	.500			14.30	1.71	16.01	25.5
	1130	Over 16" diameter pipe		176	.364	S.F.		10.40	1.25	11.65	18.2
	1200	With glove bag, up to 8" diameter pipe		40	1.600	Ea.	6	46	5.50	57.50	87
	2000	Scrape foam fireproofing from flat surface		2,400	.027	S.F.		.76	.09	.85	1.1
	2100	Irregular surfaces		1,200	.053			1.53	.18	1.71	2.4
	3000	Remove cementitious material from flat surface		800	.080			2.29	.27	2.56	4.1
	3100	Irregular surface		400	.160			4.58	.55	5.13	8.1
	6000	Remove contaminated soil from crawl space by hand		400	.160	C.F.		4.58	.55	5.13	8.1
	6100	With large production vacuum loader	A-12	700	.091	"		2.62	.97	3.59	5.1
	7000	Radiator backing, not including radiator removal	A-9	1,200	.053	S.F.		1.53	.18	1.71	2.4
	9000	For type C (supplied air) respirator equipment, add				%					10%
850	0010	WASTE PACKAGING, HANDLING, & DISPOSAL									
	0100	Collect and bag bulk material, 3 C.F. bags, by hand	A-9	400	.160	Ea.	.65	4.58	.55	5.78	8.1
	0200	Large production vacuum loader	A-12	880	.073		.65	2.08	.77	3.50	4.1
	1000	Double bag and decontaminate	A-9	960	.067		.65	1.91	.23	2.79	4.1
	2000	Containerize bagged material in drums,per bag	"	800	.080		2.15	2.29	.27	4.71	6.1
	3000	Cart bags 50' to dumpster	2 Asbe	400	.040			1.14		1.14	1.1
	5000	Disposal charges, not including haul, minimum				C.Y.					42
	5020	Maximum				"					160
	9000	For type C (supplied air) respirator equipment, add				%					10%
860	0010	DECONTAMINATION CONTAINMENT AREA DEMOLITION and clean-up									
	0100	Spray exposed substrate with surfactant (bridging)	A-9	6,000	.011	S.F.	.27	.31	.04	.62	
	0200	Flat surfaces		4,000	.016	"	.32	.46	.05	.83	1.1
	0250	Irregular surfaces		2,000	.032	L.F.	.52	.92	.11	1.55	2.2
	0300	Pipes, beams, and columns		8,000	.008	S.F.	.20	.23	.03	.46	
	1000	Spray encapsulate polyethelene sheeting		8,000	.008	"		.23	.03	.26	
	1100	Roll down polyethelene sheeting		400	.160	Ea.	.66	4.58	.55	5.79	8.1
	1500	Bag polyethelene sheeting		2,400	.027	S.F.		.76	.09	.85	
	2000	Fine clean exposed substrate, with nylon brush		4,800	.013			.38	.05	.43	
	2500	Wet wipe substrate		6,400	.010			.29	.03	.32	
	2600	Vacuum surfaces, fine brush									
	3000	Structural demolition	A-9	2,800	.023	S.F.		.65	.08	.73	
	3100	Wood stud walls		4,200	.015			.44	.05	.49	
	3500	Window manifolds, not incl. window replacement		2,000	.032			.92	.11	1.03	
	3600	Plywood carpet protection		4,800	.013		.04	.38	.05	.47	
	5000	HEPA vacuum and shampoo carpeting		8,000	.008			.23	.03	.26	
	9000	Final cleaning of protected surfaces									
870	0010	ENCAPSULATION WITH SEALANTS									
	0100	Ceilings and walls, minimum	A-9	21,000	.003	S.F.	.22	.09	.01	.32	

Potable Water Heater
Fort Greely Utility Study
Install Potable Water Heater
for Freeze Protection

Designed By: DEJ
Estimated By:

Prepared By: TCP

Preparation Date: 01/04/96
Effective Date of Pricing: 01/04/96

Sales Tax: 0.00%

M C A C E S G O L D E D I T I O N
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Currency in DOLLARS

No Backup Reports...

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	QUANTITY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST	UNIT COST
2 Bldg. 606 - Central Steam Plant	1.00	EA	9,049	72	2,988	139	12,176	12176.28
TOTAL Potable Water Heater	1.00	EA	9,049	72	2,988	139	12,176	12176.28
Contractor's Overhead							1,826	
SUBTOTAL							14,003	
Contractor's Profit							1,400	
SUBTOTAL							15,403	
Contractor's Bond							462	
TOTAL INCL INDIRECTS							15,865	
Escalation							635	
SUBTOTAL							16,500	
Contingency							3,300	
TOTAL INCL OWNER COSTS							19,800	

F8-3

2.09. HVAC	QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
2. Bldg. 606 - Central Steam Plant							
2.09. HVAC This system includes all equipment, distrbution systems, controls, and energy supply systems required by the heating, ventilating, and air conditioning system.							
2.09.02. Heating Generating Systems This subsystem includes steam, hot water, furnace, and heater systems. Fuel include coal, oil, gas and electric unless otherwise noted.							
2.09.02.02. Hot Water Boilers Assemblies include boilers, expansion tanks, chemical feeders, air separators, pumps, heat exchangers, boiler feed units, etc. This assembly would also include fittings and specialties and the flue stack. The unit of measure at the assembly level is each.							
M MIL AA <15621 2003 > 400MBH CI Gas/Oil Fired H2O Blr	1.00	EA	7,977	41	1,675	126	9,778
TOTAL Hot Water Boilers			7,977	41	1,675	126	9,778
TOTAL Heating Generating Systems			7,977	41	1,675	126	9,778
2.09.04. Distribution Systems This includes systems that distribute heated and cooled air, ventilating and exhaust air, hot and chilled water, steam, and glycol heating.							
2.09.04.03. Hot Water Distribution Systems Assemblies include pipe and fitting, including supports, wall and floor sleeves, and pipe insulation. The unit of measure at the assembly level is MBH.							
M MIL AA <15141 4033 > 40GPM Brz Cntrf Pump w/2" Disch Booster Pump w/20' Head & 1/3 HP	1.00	EA	361	3	134	1	497
M MIL AA <15061 1606 > 2"(50mm) A-53 Pipe, Sch 40 Not Incl Hangers or Fittings	80.00	LF	147	8	350	3	501
M MIL AA <15101 1302 > 2" Iron Body Gate Valve, Thrd 125# Bronze Mtd w/Threaded Valve	2.00	EA	161	2	81	1	243
M MIL AA <15061 1636 > 2" 90 Degree ELL,150# MI Black	6.00	EA	12	3	135	1	148
M MIL AA <15061 1696 > 2" Tee, Red Out 150# MI Black	2.00	EA	7	2	67	1	74
M MIL AA <15855 1134 > 8"x 5' Round Flue/Vent Pipe Galv Dbl Wall Breech/Smoke Pipe	3.00	EA	81	3	123	1	205
M MIL AA <15855 1184 > 8" Round Flue/Vent Pipe Tees Galv Dbl Wall Breech/Smoke Pipe	1.00	EA	23	1	51	1	74
M MIL AA <15855 1214 > 8"Rnd Flue/Vent Adj Roof Flash Galv Dbl Wall Breech/Smoke Pipe	1.00	EA	10	0	16	0	26
M MIL AA <15855 1194 > 8" Round Flue/Vent Top Caps Galv Dbl Wall Breech/Smoke Pipe	1.00	EA	15	0	16	0	32
M MIL AA <15063 1004 > 1"(25mm) Cu Pipe/Tubing Type L Flue Drain	15.00	LF	19	1	43	0	63
M MIL AA <15104 1103 > 1" Threaded Ball Valve, CS Trim Regular Port, Flue Drain	1.00	EA	18	1	24	0	42

		QUANTY	UOM	MATERIAL	MANHRS	LABOR	EQUIPMNT	TOTAL COST
2.09. HVAC								
M MIL AA <15063 1044 >	1" 90 Degree Elbow, Copper Flue Drain	3.00	EA	2	1	36	0	39
M MIL AA <15063 1006 >	1-1/2"(40mm) Cu Pipe/Tubing Tp L	15.00	LF	33	1	57	1	91
M MIL AA <15185 1005 >	1-1/2"D Pipe,1"Thk Fib Pipe Cvr w/Fire Retardant Jackets	15.00	LF	17	1	41	0	59
M MIL AA <15122 1105 >	1-1/2" x 1-1/2" Brz PRV, Thrd Boiler Relief Valves	1.00	EA	130	1	36	0	166
M MIL AA <15061 1635 >	1-1/2" 90 Deg Ell, 150# MI Black Boiler Relief Valve	1.00	EA	1	0	18	0	19
M MIL AA <15092 1201 >	2.07" ID Steel Pipe Sleeve Roof Pipe Boot	1.00	EA	25	1	40	1	66
M MIL AA <15063 1003 >	3/4"(20mm) Cu Pipe/Tubing Type L Boiler Drain	10.00	LF	9	1	24	0	33
M MIL AA <15063 1043 >	3/4" 90 Degree Elbow, Copper Boiler Drain	2.00	EA	1	0	19	0	20
TOTAL Hot Water Distribution Systems				1,072	31	1,312	13	2,398
TOTAL Distribution Systems				1,072	31	1,312	13	2,398
TOTAL HVAC				9,049	72	2,988	139	12,176
TOTAL Bldg. 606 - Central Steam Plant				9,049	72	2,988	139	12,176
TOTAL Potable Water Heater				9,049	72	2,988	139	12,176